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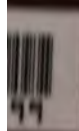
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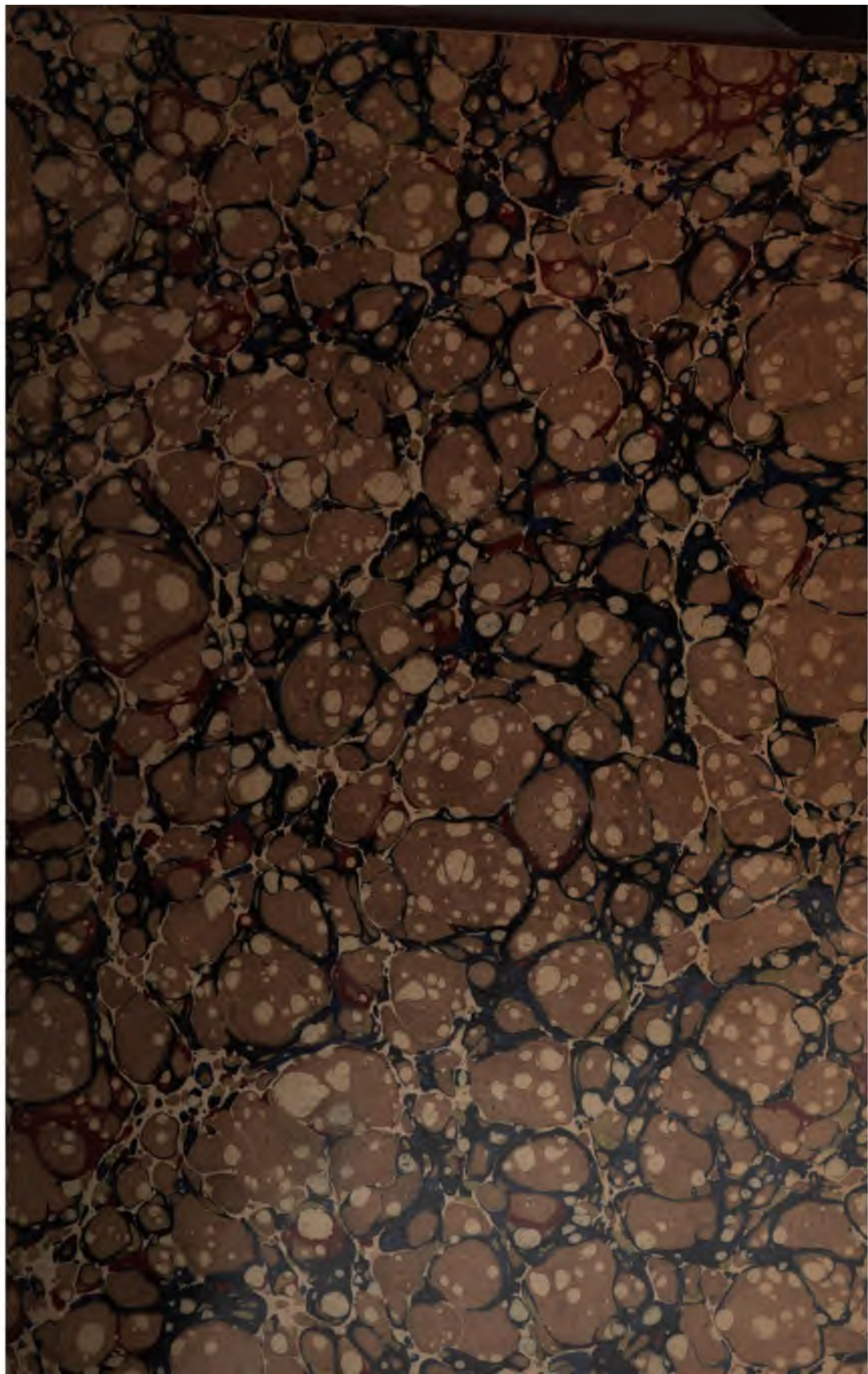




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The JOURNAL of GEOGRAPHY

*A Monthly Magazine Devoted to the Interests of Teachers of Geography
in Elementary, Secondary and Normal Schools*

Ray Hughes Whitbeck, Editor
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The JOURNAL of GEOGRAPHY

Volume XIV

SEPTEMBER 1915

Number 1

THE MONEY VALUE OF RAINFALL IN SELECTED CROP AREAS OF THE UNITED STATES*

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INTRODUCTION

THE two great cereal crops of this country are corn and wheat. Over one hundred million acres are sown to corn annually, which produce a crop of about two and one-half billion bushels. An area about half as great is sown to wheat each year, which yields a crop of approximately eight hundred million bushels. The average value of these two crops alone is over two billions of dollars; that of corn being somewhat more than twice that of wheat.

A sufficient amount of moisture is, of course, essential to any crop. Were the moisture conserved the year round, a mean annual rainfall of 11 inches would be adequate in the northern part of the Great Plains, as in a similar region in Russia good crops are grown. The water required to mature 1 pound of dry matter in wheat is from 200 to 500 pounds in moist climates; from 325 to 500 pounds in Wisconsin; and about 750 pounds in Utah and similar dry climates. This means that a rainfall of 4 to 5 inches will produce a crop in dry climates *if all is conserved*. With proper care about half of the moisture can be retained for use by the growing crop. Indeed in Utah, crops have been grown for 30 years, without irrigation, on a mean annual rainfall of 14.5 inches and in places even less.

The variety of wheat grown influences the yield greatly, especially in times of drought. In Western Dakota in 1904, it was exceptionally dry. The hard spring variety of wheat, "Pedigreed Bluestem," fell to 11.8 bushels, but the "Kubanka" variety of durum wheat yielded 23.5 bushels per acre.

In general it may be stated that Mediterranean climates require less rainfall to produce crops than Continental climates. It is in the Mediterranean climate of California that wheat is grown without irrigation with the least rainfall of any place in the United States. Here crops are grown where the mean precipitation is only 10.3 inches, while on the edge of the Great Plains in Kansas, 19.8 inches are needed.

It is possible, upon the basis of results obtained, to make some fairly accurate predictions with regard to future wheat and corn yields in the various regions studied.

*This article is an abridgment of a portion of a thesis submitted for the degree of M.A. at the University of Wisconsin in June, 1915.

RELATION BETWEEN WHEAT YIELD AND RAINFALL IN REGIONS OF LOW RAINFALL

It was found that there is a close relationship between rainfall and wheat yield in regions having a low rainfall during the growing season. The following discussion is an attempt to express this relationship in definite mathematical form.

(1) *Relation of the average yield of wheat to the average rainfall in North Dakota.* The study covering the last two decades, shows that, during the three best years, 1902, 1905, and 1912, an average of 7 inches of rainfall yielded an average of 18.3 bushels of wheat per acre; that the three poorest years, 1900, 1910, and 1911, with an average rainfall of 3.6 inches, yielded 6.2 bushels per acre; and that the sixteen medium years, with an average of 6.1 inches of rain, yielded 12.2 bushels per acre. It is thus apparent that the average yield per acre is practically twice the May and June rainfall (in inches); that it is somewhat more than twice the rainfall in extra good years, and somewhat less than twice in the poorest years.

(2) *Relation of the average rainfall to the average wheat yield in South Dakota.*

The six poorest years, 1911, 1904, 1900, 1897, 1894, and 1893, gave an average of 7.2 bushels of wheat with a rainfall of 4.4 inches. The four best years, 1912, 1909, 1905, and 1903, gave 14.0 bushels per acre with 7.6 inches of rainfall. The 12 medium years gave 12.5 bushels with 7.4 inches of rain.

The average yield of wheat in this state is thus but 1.7 times the May and June rainfall.

(3) *Relation between the wheat yield and the average rainfall of the wheat districts in California.* In the wheat regions of California, the four best years, 1872, 1880, 1884, and 1906, produced an average of 18.9 bushels of wheat with an average rainfall in the region (reckoned from that at Sacramento), for the months of January, February, March, and April, of 18.9 inches.

In the six poorest years, 1870, 1871, 1885, 1898, and 1905 (see Table 5), an average of 6.7 inches of rain gave 8.1 bushels of wheat; while in the 32 medium years an average of 11.9 inches of rain yielded 12.6 bushels of wheat.

Thus in the best years,—i. e. those years which yielded over 17 bushels per acre,—the average yield was identically the same as the average rainfall for the months of January, February, March and April.

In the poorest years,—i. e. those years with a yield of less than 10 bushels per acre,—the average yield was about 1.2 times the average total rainfall for the four critical months.

In average or medium years, the yield was but slightly greater than the average total rainfall during the critical months.

(4) *Relation between the average wheat yield and the rainfall of the wheat regions, in Washington.* In the state of Washington, the wheat yield averages almost exactly 4 times the average rainfall in the three chief wheat-growing counties, Whitman, Lincoln and Adams, during the four months of January, February, March and April. It is slightly greater ($4\frac{1}{4}$ times the rainfall) in the best years, and considerably less in the poorest years ($2\frac{1}{2}$ times the rainfall).

(5) *Relation between the wheat yield and the rainfall in Kansas and Nebraska.* Here the four poorest years yielded 9.3 bushels of wheat per acre, with an average of 5.28 inches of rainfall during the months of March, April and May. The thirteen medium years gave 14.4 bushels with 7.9 inches of rain. The six best years gave 16.9 bushels with 8.1 inches of rain.

Thus, the average yield was slightly less than twice the rainfall for the three critical months both in the poorest years and in average years, and slightly greater than twice in the best years.

RELATION BETWEEN RAINFALL AND WHEAT YIELD IN STATES WITH ABUNDANT RAINFALL

1. A comparison of the rainfall during May and June, in the state of Minnesota, for years with large yields and those with poor yields is quite significant.

The four poorest years, 1893, 1900, 1906, and 1911, gave an average of 10.3 bushels per acre with an average rainfall of 6.15 inches. The four best years gave 18.35 bushels per acre with an average rainfall but slightly less than that which returned the poorest yields (6.05 inches).

These results indicate that there is no direct relation between the average rainfall and the wheat yield in this state. Hence it is not possible to predict the wheat crop for any series of years upon the single basis of total rainfall for any period.

(2) *Relation between the rainfall and the wheat yield in Ohio, Indiana, Illinois and Missouri.* Here the relation between wheat yield and rainfall is much the same as in Minnesota.

That no definite mathematical relation exists between the wheat crop of states having an abundant rainfall, and the precipitation during the growing season is evident. The results in all cases indicate, however, that the best crops can be expected when the rainfall is below the normal amount during the critical months of the growing season.

RELATION OF RAINFALL TO CORN YIELD

(1) *Relation of rainfall to corn yield in Ohio.*

(a) The seven best years, 1855, 1872, 1874, 1896, 1900, 1906, and 1912, yielded an average of 41.3 bushels of corn with an average rainfall during July of 5.7 inches.

(b) The eleven poorest years, 1854, 1856, 1858, 1859, 1863, 1867, 1883, 1890, 1893, and 1901, gave 27.5 bushels with 2.8 inches of rain.

(c) The average or medium years with 4.1 inches of rain, gave 34.4 bushels of corn per acre.

Thus the average yields and the best yields are 8.2 times the July rainfall in inches, and the poorest yields are about 10 times the rainfall for this month.

(2) *Relation of rainfall to corn yield in Kansas.* In Kansas, the six poorest years gave 11.9 bushels per acre with 1.82 inches of rainfall. The six best years gave 29.4 bushels with 4.5 inches of rain; and the fifteen medium years gave 21.8 bushels with 4.22 inches of rain.

Thus in average years the yield of corn here is about 5 times the July rainfall, while in the best and poorest years it is $6\frac{1}{2}$ times the rainfall for this month.

(3) *Relation of rainfall to corn yield within the entire Corn Belt.* The yield of corn for the entire "Corn Belt" can be predicted with considerable accuracy from an analysis of the yield and rainfall of past years.

The five poorest years throughout this belt gave an average of 21 bushels of corn per acre with an average rainfall of 2.2 inches for the month of July.

The five best years gave 34.6 bushels per acre with an average of 4.8 inches of rain.

The seventeen medium years gave 31.2 bushels with an average rainfall of 3.9 inches.

Thus in average years, the yield of corn throughout the corn belt was approximately 8 times the July rainfall. In the best years, however, the yield was only 7 times the rainfall for this month, and in the poorest years it was 10 times as great.

VALUE OF VARIOUS AMOUNTS OF RAINFALL TO THE CHIEF WHEAT- AND CORN-PRODUCING STATES

By a proper arrangement of the data obtained, it is possible to show the approximate money value of different amounts of rainfall to each crop within certain areas. Of course, such evaluations are of value only in so far as the yield of the area dealt with depends upon rainfall.

(1) *Value of rainfall to South Dakota.* From the data available the following results are obtained:

The average yield of wheat where the rainfall for May and June was from 3 to 4 inches was 8.9 bushels;

with a rainfall of 6—7 inches, the yield was 12.1 bushels;
with a rainfall of 7—8 inches, the yield was 12.5 bushels;
with a rainfall of 8—9 inches, the yield was 12.3 bushels;
with a rainfall of 9—10 inches, the yield was 13.1 bushels.

The average difference in yield for each inch of rainfall for amounts between 3 and 10 inches is 0.8 bushels per acre.

The average acreage of wheat in South Dakota from 1891-1912 has been 3,000,000 acres. The average price of wheat here has been \$0.60 per bushel. The acreage in 1915 was about 4,000,000 acres and the price about \$1.20 per bushel.

Combining the above data, gives the *average value of one inch of rainfall*, during May and June, to the wheat-growers of South Dakota, as $3,000,000 \times 0.8 \times \$0.60$ or \$1,440,000.

The difference in value between a 3 to 4-inch rainfall and a 6 to 7-inch fall was \$5,760,000.

The difference in value of the crop in years when the rainfall averaged less than 5 inches and when it was more than 5 inches was \$6,840,000.

The value of an inch of rainfall to this state in 1915 was somewhat over \$3,800,000 for the wheat crop alone.

(2) *Value of rainfall to North Dakota.*

A similar series of computations for North Dakota shows that the average increase in yield has been 1.2 bushels per acre for each inch of rainfall above 4 inches; that is, the average value of one inch of rainfall to the wheat-farmers of North Dakota is \$3,350,000.

The difference in value of the crop in years with a rainfall less than 5 inches and in years when it was over 5 inches was \$10,000,000.

(3) Similar computations show that in California each inch of rain during the four months included in January to April was valued at about \$1,500,000. The difference between a 6.7 inch rainfall and a 19 inch rainfall in those four months amounted to about \$18,000,000.

(4) *Total value of one inch of rainfall to the six states of North Dakota, South Dakota, California, Washington, Kansas, and Nebraska.* The total value of one inch of rainfall during the critical period in ordinary years, to these six states is approximately \$15,000,000 for the wheat crop alone. During 1915 due to war prices this inch of rainfall was worth about \$25,000,000 to these states.

VALUE OF RAINFALL TO CORN-PRODUCING STATES

In the preceding paragraphs, there was found to exist a close dependence of corn yield upon rainfall, throughout the entire corn belt. It is a fact worth noting that in this belt the highest average yield of corn per acre is in the state (Ohio) having the highest average rainfall during the critical month of July. Furthermore, the other states follow in order of both decreasing rainfall and yield;—Indiana, Illinois, Iowa, Nebraska, and finally Kansas, in the order given. Within this belt it is possible to estimate the value of various amounts of rainfall with a considerable degree of accuracy. The larger the area considered, the greater the accuracy of the estimate. Computations were

made for each of the states of the corn belt, but only results for the belt as a whole are here given.

An excess of rainfall in July has always been followed by a large corn crop when the entire corn belt is considered, whereas a deficiency during July has almost always caused a short crop. The correlation between rainfall and corn yield here is very close and the following results should be correspondingly accurate.

When the July rainfall has averaged from 2 to 3 inches over this entire belt, the average corn yield has been 23.2 bu. per acre. When the rainfall was from 3 to 4 inches, the yield was 29.7 bu. per acre. When the rainfall was 4 to 5 inches the yield per acre averaged 32.5 bushels. For those years when the rainfall for July averaged $\frac{1}{2}$ inch below normal or less, the yield has been 23 bu. per acre. When the rainfall averaged $\frac{1}{2}$ inch or more above normal during this critical month, the yield has been 33 bu. per acre.

The average area devoted to corn in this belt is about 50,000,000 acres. The average price received by the farmer for his corn is about \$0.50 per bushel. One inch of July rainfall above 3 made a difference of 6.5 bu. per acre in the corn yield. This means a difference of \$160,000,000 for this inch of rain.

One inch of rainfall above 4 inches made a difference of 2.8 bu. per acre. This means a difference of \$70,000,000 for this inch of rain.

When the rainfall for July averaged less than 3.4 inches, the yield of corn averaged 10 bu. per acre less than when the fall was more than 4.4 inches. This makes a difference of about \$250,000,000 in the corn crop.

These results have held true for a long series of years, and as the territory considered is large, should hold true in a large measure for the future.

WHAT IS A PLACER?

A placer is an unconsolidated deposit accumulated by mechanical processes, carrying one or more minerals in commercial quantities. All placers are secondary deposits—that is, the material of which they are composed was originally derived by erosion of bedrock. Although it is undoubtedly true that under certain conditions nuggets of placer gold have been enlarged through chemical precipitation, yet this action is a negligible quantity in placers. Placers may be derived solely by rock weathering without water sorting, but more commonly are the result of water transportation, sorting, and deposition. Many of the richest placers are those formed by the erosion of older placers and the reconcentration of their gold.

THE RIO THEODORO, COLONEL ROOSEVELT'S NEW RIVER

By J. Paul Goode
University of Chicago

THE ordinary map of South America, even as given in the better atlases, does not suggest any large uncertainties in the details of drainage. The rivers *look* natural enough, and are supplied with what seems like ample systems of tributaries. Yet in the most carefully made maps, such as those in the large atlases of Andree or Debes, one finds significant open spaces between some of the larger tributaries of the Amazon marked "unerforscht" (unexplored), and with the tell-tale dotted lines of uncertain drainage.

It was through the heart of the largest of these blank spaces that the famous expedition of Colonel Roosevelt journeyed a year ago. And this expedition gave the world a new great river, which carries more water than the Hoang Ho, perhaps three times as much water as the Rhine, a river almost as long as the Ohio River, through a hitherto unknown area larger than the state of Nevada.

How Colonel Roosevelt found the opportunity of coupling his name with this river, is in itself an interesting bit of geography. The river runs through the heart of the great plateau of Matto Grosso, a region of high rainfall, and dense tropical forest, a region where the rubber trees are found at their best. Now the demand for rubber in the world has been increasing by leaps and bounds; and all the rubber lands easily reached along the lower courses of the tributaries of the Amazon being occupied, the rubber men were pushing up every lesser tributary, farther and farther into the wilderness, and the plateau margin along the Madeira River came to be the richest and most promising of the new rubber fields.

The Brazilian government is very much alive in its wish to develop these new great states of Matto Grosso, Amazonas and Acre. The region of the plateau is seriously handicapped, in that its northward flowing rivers are much interrupted by rapids and falls, making river navigation quite impossible. So a great plan has been adopted of connecting this plateau by rail with the nearest Atlantic port of Sao Paulo. Much of the line is built from the southern end, and in the past half dozen years the engineers of the army have been pushing the surveys to the northwest, and laying an advance telegraph line to the falls of San Antonio on the Madeira River. The officer in charge of these surveys was Colonel Candido Rondon, and his work in the years 1907 to 1909 covered a wide tract in the western extension of the plateau of Matto Grosso.

The work of this survey is of very great significance, in that it has given us definite information about the drainage, in place of hearsay, or even conjectural drainage, which has found its way even into the best of maps. The first publication* of this survey, outside of Brazil, shows how great a change there is in the position and tributaries of a large river, the Gy-Parana, and also

*Petermann's *Mittellungen*, 1910, pp. 260-261, with map, *Tafel* 47.

river in the new basin might bend to the east and join the Tapajos; or it might bend to the west and add itself to the Gy-Parana; or it might reach farther northwest and add itself to the Madeira; or it might even reach still farther north and join the Amazon in some of the little known bayous along its course. Because of all these uncertainties, Col. Rondon called it, on his own map, the Rio da Duvida, that is, the River of Doubt.

Colonel Roosevelt, having invitations for addresses from several cities in the South, wished to return over a new route, through the wilderness, and hunt and collect museum specimens of the forest life. Mr. Lauro Mueller, the eminent secretary of foreign affairs of Brazil, called his attention to this unknown river, as good "game" in itself, and Mr. Roosevelt was glad of the "opening." So the Brazilian government sent Col. Rondon with a corps of army engineers, to co-operate with Colonel Roosevelt in following this river to its mouth, and putting it on the map; and the venture was officially called the "Expedicao Scientifica Roosevelt-Rondon."

The results of this venture all the world now knows, and every geography student and teacher will enjoy immensely reading the intensely interesting story of it in the account given by the senior commander himself.*

The river as now known, trends almost due north from the place where Col. Rondon left it, as the Rio da Duvida in 1909, and proves to be a great river, the largest tributary of the Madeira, perhaps nearly a thousand miles long. Col. Rondon, his first assistant Lieut. Lyra, and Kermit Roosevelt made a detailed survey of the river through its whole course. Latitude observations were made at each half degree of latitude, and the positions taken have been coupled up with astronomically proved stations near the source and near the mouth. Doubtless no river of equal size has ever been so accurately mapped in its first navigation.

In the accompanying map (p. 8) the position of the new river is indicated, beyond the point reached by Col. Rondon in 1909, by a line with dots alongside. One may see from this, how very much the drainage established by the actual survey differs from that given in the earlier maps.

Col. Rondon was authorized by the Brazilian government to name the river, if it turned out to be a large one, in honor of Colonel Roosevelt. So when they reached the mouth of the river, a monument was erected, and the river formally christened Rio Roosevelt. But when the survey data reached Rio de Janeiro, the government felt that Mr. Roosevelt's christian name, in the Portuguese form, would be a more appropriate form than the unfamiliar and foreign sounding name Roosevelt. So it goes down on the map for all time as Rio Theodoro**.

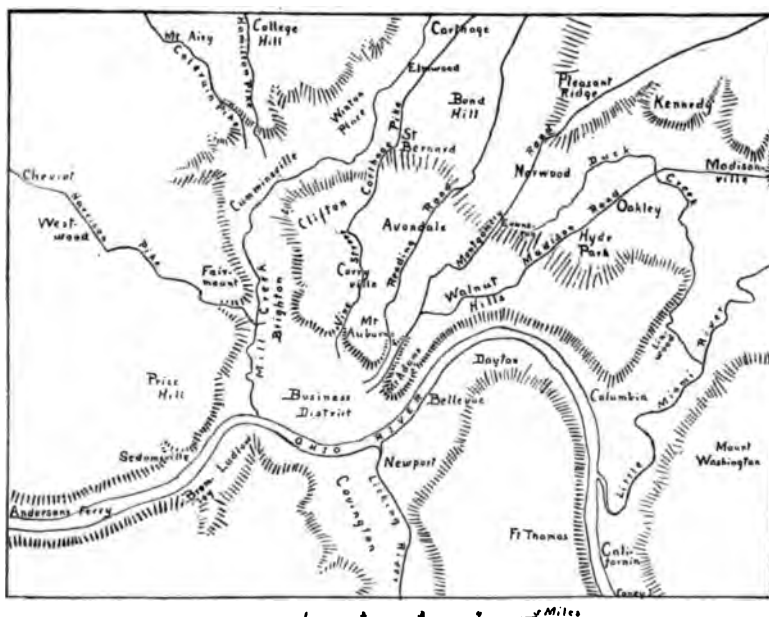
*Roosevelt, Theodore; *Through the Brazilian Wilderness*; N. Y. Scribners, 1914. 80. pp. XIV+383. Maps and illustrations.

**Some confusion has been introduced by the press, in the form of the name. It was first printed in the Spanish form, Rio Teodoro, with an accent over the "e" which does not belong in the Spanish name. Nor is there any accent used in the Portuguese form Rio Theodoro. See W. L. G. J. in *Bull. Am. Geog. Soc.*, July, 1914, pp. 512-519; also *Geographical Journal*, Feb. 1915, with a very detailed map on a scale, 1/400000; also a note in *Bull. Am. Geog. Soc.*, May 1915, pp. 361-362, and a fine map on a scale of 1/2000000. See also Joerg. W. L. G. "The Geographical Results of the Roosevelt-Rondon Expedition" in the *American Museum Journal*, March 1915, pp. 129-132, with maps.

THE SITE OF CINCINNATI

By N. M. Fenneman
University of Cincinnati

SURROUNDING region. North of Cincinnati for several hundred miles extends a once forested, nearly flat plain, being cut into hills only near the larger streams. It is the eastward extension of the chief farming district of the United States. To the south for an equal distance is a hilly country surrounding the Blue Grass Region, an oval area 40 to 60 miles in diameter with a mildly rolling surface and very fertile soil. The forests of these areas (containing much hickory) once made Cincinnati a leading center of buggy manufacture. The start thus given has still left it an important hardwood market. First the mast (acorns, etc.) and later the corn raised in this region made Cincinnati a center of pork production. In a similar way the grain made it in early times a center of flour and whiskey manufacture.



SITE OF CINCINNATI

Communications. The Ohio is a natural highway, part of a 10,000 mile system. It is here crossed by a natural north-south land route, the Licking Valley to the south and Mill Creek and Miami Valleys to the north. This line of valleys caused, in succession, a concentration of Indian trails, wagon roads, canals and railroads. No other equally favorable north-south route crosses the Ohio.

Within the area adjoining Cincinnati there is little of mineral resource except building stone for home use, but the presence of the Ohio makes coal

transportation so cheap and easy that they may be regarded as part of our environment.

Site. A low plateau about 900 feet above sea level, is here trenched by the Ohio to 430 feet above sea level. This trench has steep bluffs generally less than a mile apart, but at this point more than 2 miles apart. The Little Miami, Mill Creek and Duck Creek occupy much broader trenches, made before the glacial period when the chief streams followed different lines from those of the present. The bluffs of all these great trenches are cut into hills by ravines, or by valleys which began as gullies and ravines. Back a few miles from the bluffs the upland is nearly level.

Within these great trenches are terraces of sand and gravel. On such a terrace, several miles wide, stands the business section of Cincinnati 100 feet above the river, but still 300 feet below the adjacent uplands of the residence sections, and separated from them by the bluffs which here swing far back from the river. As elsewhere, these bluffs are scalloped by side valleys which subdivide the adjacent upland.

Influence of environment. These features of the site are the cause of much that is distinctive in the plan of Cincinnati and in its daily life, public and private. The first roads to distant villages ascended to the upland by following the side valleys. Thus were determined Gilbert Avenue (Montgomery Road and Madison Road), Reading Road, Vine street (Carthage Pike) and Harrison Avenue, all shown on the accompanying map. The villages of Walnut Hills, Avondale, Corryville and Westwood grew up along these roads. The slope of the steep bluffs overlooking the city has almost prohibited road-making, with the result that these have been but sparingly occupied by homes of a humble sort. Traffic up and down these slopes is by inclines.

One of the distinctive features of Cincinnati is its origin in a great number of independent communities or villages, each occupying its own hilltop, like Clifton, Mt. Auburn, Mt. Adams, Walnut Hills, Price Hill or Westwood, or more or less isolated in valleys like Cumminsville, Brighton, Columbia and Norwood (a separate corporation). An inheritance from this condition of separate communities is the large number (40 or more) of local Improvement or Welfare Associations which are now so important in forming and expressing public sentiment.

Another influence of the peculiar topography is found in the extraordinary number of large and beautiful private grounds surrounding suburban homes. Above and beyond the bluffs there was no lack of room, but much of the area was dissected by ravines, making it difficult to construct streets, without which small lots could not be laid out. Even now the city embraces much unimproved ground of this character. With increasing density of population, new streets have been graded and many of the old homesteads have been subdivided.

The peculiar character of the city's parks is determined by the same principles. Eden Park and Burnet Woods and the university campus occupy areas of exceptionally deep and beautiful ravines (some of which have been leveled up at great expense to the city). The ultimate park plan includes the steep slopes of the now unsightly bluffs, an opportunity almost unique among cities.

The flat portion of the city east of Mill Creek Valley (about 4 square miles) is still far too large to be used exclusively for business. As a residence district it is decadent. The price of ground is however much too high to admit of private yards. Much of this area is therefore occupied by buildings 2 to 4 stories high, the first floor being used for small stores and shops and the upper floors for homes. Residence is much congested in these parts of the city. At the same time the business of the city is greatly congested on narrow streets within a small district having no natural limits. The streets within this district are among the most crowded city streets in the United States. It would be far better in the next 100 years to fill the basin with business blocks from six to ten stories high, and thus displace the poorer tenement quarters, than to line a few narrow streets with sky-scrapers.

Completely encircling the city is a strip of low ground, the Ohio, Little Miami, Duck Creek and Mill Creek Valleys. Manufacturing tends more and more to occupy this low strip. The railroads are necessarily there also. The lower part of Mill Creek Valley, in part occupied by railroads and factories and in part waste ground, affords a natural site for a great harbor.

WELLS MORE THAN A MILE DEEP

The deepest well in the world is in South Africa, over 8000 feet deep; another deep well is in Upper Silesia, in the German Empire, 7,350 feet deep. A well in the United States which may go deeper according to the United States Geological Survey, is about 15 miles west of Pittsburg. This well was 7,174 feet deep in June. Some gas and oil were struck in the upper part of the well. Between the depths of 6,830 and 7,100 feet rocks bearing rock salt and salt water were encountered. The temperature in this well at the depth of 6,775 feet, as recently determined with great accuracy, is 145.8 degrees Fahrenheit.

At Derrick City, McKean County, Pa., near Bradford, there is a well 5,820 feet deep, which is probably the second deepest well in the United States. Another deep well is in Kanawha County, W. Va.; it is 5,595 feet deep. Deep well drillers in this country of course employ the most improved and effective rigs, but one of the most remarkable of wells, reaching a depth of 3,600 feet, was drilled for petroleum in western China by means of such crude appliances as a cable made of twisted strands of rattan.

GEOGRAPHY IN THE ST. LOUIS ELEMENTARY SCHOOLS

A REPORT OF PROGRESS BY THE CHAIRMAN OF THE SUB-COMMITTEE
W. J. Stevens

IN September, 1913, Mr. Blewett, Superintendent of Schools of St. Louis, appointed a general committee and about twenty sub-committees to examine the course of study in the elementary schools with a view to recommending revisions, if it were deemed necessary, and to formulate reasons for such revisions.

The general committee took for its work (1) the formulation of the principles that should determine what ought to be found in the course, (2) the receiving and discussing of the preliminary reports of the sub-committees, and (3) the final action upon the completed reports of these committees.

To the sub-committees were given the task of determining the content of the course in each subject, maxima and minima, and recommendations as to time of introduction of the study, time allotment, and method of presentation. These sub-committees were to present a preliminary report to the general committee for joint consideration and discussion, and, after amendments and suggestions, were to prepare a final report.

The committee on geography began its work in the spring of 1914 by making an examination and comparison of the work attempted in this subject in various sections of the country with a view to determining the content and time allotment. The committee also sent out a questionnaire to representative men and women in various professions and industrial and commercial enterprises to get their opinion as to the value of geography in their respective vocations.

The study of the courses in geography in the various cities had some surprises, and indicated a greater range in the kind and amount of attention given to geography than in any other of the common branches. It was found that some schools introduce the subject in the first grade, the majority in the third grade, a considerable number in the fourth grade and a few do not begin the subject until the fifth grade is reached. The time allotment also varies greatly as the following indicates:

Glass-hours given to geography in the grades—

City	Total hours	City	Total hours
Boston	690	Tacoma	542
Worcester	665	Chicago	510
Cincinnati	660	New York	495
Rochester	644	Pittsburg	490
Jersey City	630	St. Louis	367
Syracuse	580		

The answers to the questionnaire indicated that few employers or managers of commercial or industrial enterprises regard geography as of specific

and direct value as a preparation for the vocations. Its chief value, which most recognize, is its service in developing a greater degree of intelligence and hence its contribution to preparation for any vocation where intelligence is of special value.

The committee on geography has submitted its preliminary report in which it recommends that the subject be begun in the third grade and that there be an inductive study in the third and fourth grades. They advise that this study be organized largely about the subjects food, clothing, shelter, and transportation. They accept the definition, as a working guide, that *geography is primarily a study of the relationship between man and his environment*. They maintain that its study requires:

1. A consideration of two classes of facts, (1) those relating to the life and activities of man, and (2) those relating to his physical environment—earth, water, air, plants, animals.

2. The natural interests of children in living things determines the point of departure, man and his needs. This involves:

- (a) A consideration of the material needs of man—food, clothing and shelter.

- (b) A study of the means of increasing and satisfying his social relations through travel and transportation.

- (c) A consideration of the relation of the social institutions of vocation and government to his development and needs.

3. The earth is man's home. Its land surface, waters and the conditions of the atmosphere affect him. They modify his life through the calls they make upon his energy. Through his efforts he overcomes them and makes them minister to his needs. Hence the relation of man and the earth is one of mutual interdependence. Geography must make this clear. This necessitates some study of the products of the fields, mineral products, animal life, natural phenomena, and a proper development of his ideas of place.

The committee recommends that in the third grade, geography be taught without a text-book. It has prepared a detailed syllabus of the work for the guidance of teachers. The experiment of using the syllabus is being made in some of the schools before the final recommendations of its adoption are made.

The committee advises that the fourth grade include the inductive study of St. Louis, Missouri, and United States. The pupils are to have a text-book, although the course will not be guided by this book, but, rather, by the syllabus and the teacher. The text becomes the source of information through its maps, pictures, and scattered statements. Supplementary readers are to be used freely, the material to be selected by the aid of the tables of contents and the indexes. Consecutive readings are not recommended except in reviews.

As an indication of the method of study in this grade, a part of the syllabus is here given.

FOURTH GRADE GEOGRAPHY, INDUCTIVE DEVELOPMENT

St. Louis

I. Industries for which people gather in St. Louis

A. Manufacturing and commerce. (Definition of factory, manufacture, raw materials, products)

1. Things needed for factory work

a. Raw materials of some St. Louis factories. (If factories are near school, study them.) Leather for shoes, harness, saddles; iron for stoves, car wheels; steel for tools and street cars; wheat for flour, bread, cakes; tobacco leaves for tobacco products; lumber for cars, furniture, houses, doors, windows and frames; cloth for clothing; barley for beer; brick and stone for buildings.

b. Buildings in which to work

c. Power to run the machines

d. Men to do all kinds of work

e. Ways to carry goods

(a) Street cars, auto trucks and horse trucks in the city

(b) Railroads and river steamers to and from St. Louis

Trace railroads on map of Missouri from St. Louis as a center.

Show use of Mississippi River.

f. Money with which to buy materials and coal, to build buildings and pay freight

2. Sources of some materials. (In order to get the idea of relations to other places. Point out regions on map of U. S.)

a. Iron from the Great Lakes region

b. Leather from Chicago and the East

c. Wheat from Missouri, Kansas and the North West

d. Lumber from the Great Lakes States, Arkansas, Louisiana, and the South

e. Cattle and hogs from all the country around

f. Cloth from the East

g. Tobacco from Kentucky

h. Zinc and lead from Missouri

i. Coal from Illinois

3. Why St. Louis can get these things easily

a. Central location (Use map.)

b. Coal near in Illinois

c. Many railroads

d. Rivers—much used before railroads and still used for coal, lumber, and bulky freight

e. Men—many in St. Louis since so much work is to be done

f. Money. Men bring it where it can be used. Much is received from the sale of products

4. St. Louis as a distributing point
 - a. Wholesale stores; traveling salesmen
 - b. Buying goods in other cities; goods needed in the trade territory of St. Louis
 - c. Factory needs
 - d. Grain elevators
- B. Needs of St. Louis. (Dependence upon other cities, upon Missouri, and on surrounding states.)
 1. Food: wheat, corn, fruit, vegetables, meat, milk, eggs. The farmer, the manufacturer, the railroads
 2. Clothing: wool, cotton, silk, leather
 3. Shelter: lumber, stone, brick, iron
 4. Market: people to buy its goods
 5. Raw materials (Trace from source to St. Louis).

Missouri

- I. People and occupations outside of St. Louis
 - A. Country life and occupations
 1. Farming: (agriculture, including stock farms, dairy farms, truck gardens near St. Louis, fruit farms)
 - a. Parts of the state having many farms and people on account of
 - (a) Surface: gentle slopes, good drainage, few rocks at surface, scenery
 - (b) Soil: rich in plant food
 - (c) Long, warm summers and plenty of rain
 - b. Parts of state having few farms and people on account of
 - (a) Surface: steep, rocky slopes. (In such regions only valleys along the streams have rich soil.) Free use of maps and pictures to learn this.
 - B. Town and village life and occupations
 1. Relations of farmers and people of towns; mutual services
 2. Towns and railroads
 - C. Other cities of Missouri
 1. Kansas City, St. Joseph, Hannibal
 - a. Location on an outline map showing the Mississippi, Missouri, and Meramec Rivers
 - b. Centers similar to St. Louis as to occupations; Kansas City and St. Joseph prominent in meat and flour industries because of location
 2. Joplin and Carthage; location center of special industry of lead and zinc mining
 3. No large cities and fewer towns in rough parts of southeast and south-central; some lead and zinc mines
 4. Jefferson City, capital.

United States

- I. Development of general ideas of the United States from maps and globe
 - A. Position: on globe and in North America; in temperate zone; teach zones without teaching causes
 - B. Size, shape, and surface
 1. On an outline map that shows state lines, color Missouri.
 2. Journey from St. Louis easterly, westerly, northerly, and southerly to the limits of the United States. Scenery including great rivers, great plains, highlands, mountain ranges. On these journeys learn Atlantic and Gulf plains; Appalachian highlands; great central plain, including Great Lakes, valleys of the Mississippi, Ohio, and Missouri rivers; the Western highlands including the Rocky Mountains, Sierra Nevada, Cascade, and Coast ranges.
- II. Some foods of the United States
 1. Wheat map. Write names of states prominent in wheat growing and color same.
 2. Physical map, for surface and soil
 3. Rainfall map for rainfall
 4. Text and supplementary readers for conditions required and fulfilled in wheat growing regions
 5. Names and locations on map of greatest wheat growing states
 6. Relation of Missouri to wheat raising
 7. Farming processes; seasons, pictures
 8. Shipping needs: include elevators, railways and Great Lakes; pictures
 9. Manufacturing. Locate and find advantages of Minneapolis, Chicago, St. Louis, Indianapolis.
 10. Export of surplus

Note: Wheat is grown more or less in all states of the northern region, also in Washington, Oregon and California. Avoid impression that it is grown in limited regions but put stress upon great regions.
- B. Potatoes
 1. to 4. Treat somewhat as in discussion of wheat.
 5. Notice correspondence with wheat states: Missouri and potato growing
 6. Farming processes
 7. Shipping needs
- C. Vegetables
 1. Relation between truck gardens and cities; scattered industry
 2. Sources of vegetables in the north in winter and early spring
 3. Advantages of transportation
 - a. Refrigerator cars

- b. Favorable location, available markets; North Carolina, Florida, Arkansas, Texas
- 4. Manufacturing
 - a. The canning and pickling industry
 - b. Regions: New Jersey, Delaware, Maryland, Pittsburg, Baltimore
- D. Fruits
 - 1. Oranges, lemons, grape fruit
 - a. Localities: from supplementary readers and text
 - b. Climate of regions, as suitable for producing
 - (a) Heat conditions
 - (b) Moisture conditions
 - in Florida
 - in California (Irrigation)
 - c. Shipping needs; refrigerator cars
 - d. Shipping points, Jacksonville, Los Angeles
 - 2. Apples, peaches, grapes, strawberries
 - a. Localities: Delaware, New York, Maryland, Ohio, Georgia, Michigan, Illinois, Missouri, Colorado, California, Oregon, Washington
 - b. Climates; contrast with conditions necessary for citrus fruits
 - (a) Heat and moisture conditions
 - (b) Irrigation
 - c. Relation to truck gardens
- E. Meats
 - 1. Ranch products
 - a. Grazing regions; great plains and western highlands
 - (a) Character of surface
 - (b) Rainfall
 - b. Conditions favoring herding rather than farming
 - c. States
 - (a) Highland: Montana, Wyoming, Idaho, Colorado; New Mexico, Oregon
 - (b) Great plains: Kansas, Nebraska, Dakotas, Oklahoma, Texas
 - d. Work of herding cattle and sheep; show pictures.
 - e. Shipping needs
 - f. Manufacturing
 - (a) Centers and advantages; Omaha, St. Joseph, Kansas City, Chicago
 - (b) Dressing and canning
 - (c) By-products: hides, tallow, glue, fertilizers
 - 2. Stock-farm products: cattle, sheep, hogs
 - a. Location in regard to farming: corn belt, oats belt, hay states
 - b. Location in regard to rainfall
 - c. Location in regard to farm crops

- (a) Feed in summer and winter
- (b) Use of poor land and woodland for pasture
- d. Locations for sheep contrasted with those for cattle and hogs
- e. Relative importance of stock farms and ranches in supply
- F. Dairy products
 - 1. Milk: location as influenced by cities; widely scattered
 - 2. Butter and cheese: New York, Ohio, Illinois, Wisconsin
 - 3. Relation to farm crops
 - 4. The creamery and cheese factory, a country town industry
- G. Sugar cane and rice
 - 1. Location, Gulf plains
 - 2. Surface and soil
 - 3. Rainfall and temperature
 - 4. Special requirements for rice
 - 5. States: Louisiana, Texas, South Carolina, Arkansas
 - 6. Farming processes; special features; negro labor; the sugar mill
 - 7. Manufacture of sugar; New York refineries
- H. Beet sugar: Michigan, California, Colorado using irrigation
- I. Fish
 - 1. Localities
 - a. North Atlantic coast, cod, halibut, mackerel
 - b. Gulf coast
 - c. Great Lakes; trout, whitefish
 - d. Pacific coast, salmon
 - 2. Conditions (Text and supplementary readers.)
 - 3. Shipping: fresh
 - 4. Manufacturing: salting, drying, smoking, canning
 - 5. Centers: Boston, Baltimore, Portland
 - 6. States: Washington, Oregon, Maryland, Massachusetts
- J. Oysters: localities
 - 1. New England coast, Long Island Sound
 - 2. Chesapeake Bay
 - 3. Shipping; fresh
 - 4. Manufacture: canning
 - 5. Centers: New York, Baltimore
- K. Salt
 - 1. Localities: New York, Michigan
 - 2. Conditions
 - 3. Process (Brief.)
 - 4. Importance in manufacture of salt fish and meats.

CONDITIONS IN CHINA

From the Annual Report of the (British) China Association, 1914-15.—Jour. Am. Asiatic Assn.

"The Republic has justified its existence in a remarkably short space of time. It has re-established the authority of Peking over the Provinces, has to a great extent suppressed disorder, and has inaugurated judicious fiscal reforms on conservative lines, as, for example, in the case of the Salt Gabelle.

There is an element of weakness in the present system of government in that it is mainly dependent on one man—the President—but the country may count itself extremely fortunate, while it has been passing through a period of violent upheaval, in having a strong man to direct the course of affairs; a weak leader, even with the best intentions, might easily have landed the whole country in anarchy. China has the good fortune, at this crisis in her affairs, to have a leader who not only knows his own mind, but also knows his fellow countrymen, who has decision of character and the courage of his opinions.

It is clear, however, that there is a great element of danger in any system of government which is dependent on any individual however eminent and capable."

J. O. P. Bland in the Atlantic Monthly.

"For the present, it is sufficient to observe that the great-man theory of government has once more been vindicated in China, and that, at a time when all the western world lies under heavy storm-clouds of war, the Celestial Republic shows signs of successfully emerging from some of the most grievous troubles of its internal disorganization. Yuan Shih-k'ai's recent mandates are an intimation to the world in general, and to Young China in particular, that the ends of autocracy have justified its means, some of which have been undeniably "frightful," and that, political agitation being barred as a means of livelihood at Peking, benevolent despotism is in a position to protect the state from the dangers which have so long threatened it from within. Of those which threaten it from without, this is not the time or place to speak; but, given a solvent exchequer and a little luck, the Velvet Glove should be able to deal with them also."

Excerpts from J. D. Whelpley's Article "East and West" in the Fortnightly Review

The serious error in Western thought and utterance concerning the China of today is the assumption that the China of yesterday has, by some hocus-pocus on the part of the revolutionists, been sent into retirement with the Manchu dynasty. There has been a substitution of rulers at Peking, pledged to different things, but the only successes recorded of their administration have been accomplished along lines familiar to Chinese politics and government for many generations past.

"The changes to take place in China will come slowly, and will be measured by the mileage of new railroads constructed. The doing away with treaty ports, the safety of the whole country for foreigners, the establishment of a national currency and banking system, the building up of strong and just local governments, a corruption-free administration in Peking, an effective fiscal system, a strong cohesive army and navy—these are things yet to come, and the road is long and full of obstacles. In the meantime, the strength of character and singleness of purpose of the Chinese people is a guarantee of the continued immutability of the nation. It is an elusive quality, this strength of Chinese character, one difficult to define, yet deeply felt by every Westerner who associates with them. The Occidental who lives many years in China never makes much headway against it. In most cases he is swamped in the depths of Orientalism. In nearly every other country where the white race has established itself among an alien population it becomes the dominant force. The white men tower above their surroundings, and are the acknowledged superiors, in authority at least, of those about them. This is not the case in China."

"The struggle for existence is the single purpose of the Chinese, and it is a struggle the cruelty and terror of which are hard to realize. They are a peaceful people, intent upon their own ends. Ghastly disasters and a terrible mortality from natural causes have so cheapened life that it counts as nothing. The country itself is ugly and commonplace to the eye, and the life of the mass of the people is sordid to an extreme. Away from the treaty ports, and out of sight of Peking, it matters not who rules the State. The work of the Chinese people is to get enough to eat, to weave on hand looms the nearly £200,000,000 worth of cloth, not imported or produced by Chinese mills, needed to clothe over four hundred million people. Great cities are lacking even in wagon-road communication with other communities. It is in these great centers of population that the mass of the people live. It is from the surrounding land that food is secured by scrupulously returning to the time-worn soil every ounce of refuse, animal and human, that its fertility may be kept at producing point."

"There is one nation that does understand China, and that is Japan. With a sympathetic mental outlook and an avowed purpose to grow great through the wealth and necessities of her vast neighbor, Japan has set herself the task of dominating the affairs of the Far East—or, in other words, to secure the best that is to be had in that part of the world for her own people."

"In the meantime, Japan progresses apace towards the goal of her ambition. Long ago her statesmen abandoned all thoughts of the Philippines, for they had proved unfavorable to Japanese settlement. There is no thought of real war with the United States, for there is too little to be gained. Everything points to a plain path for the future, the farming of China territorially and for commercial gain. It is a natural and logical outlet for Japanese energies, and no country is better fitted for this campaign. There are a hun-

dred thousand Japanese now resident in China. They speak the language, adopt the manners and customs of the Chinese, and cater to their wants with a shrewdness and completeness unknown to traders of other nationalities."

"Japan is a great Power today, and is to become greater, for she has no serious rival in that part of the world over which her sway is to be extended. It is with Japan that the West will be compelled to treat in the final settlement of all Far Eastern affairs; for with a power and supremacy which cannot be challenged, her statesmen have good reason to feel sure of their ground. Japan is even now the Dictator of the Orient."

From the North China Daily News

To any great extent, however, Chinese unity in the political sense was almost an impossibility. When intercourse was a matter of days, weeks, or months, simultaneous action was an impossibility. Moreover, there was never a time since the abdication of K'ien Lung in 1796 when the weakness of the Central Government was not a stimulus to rebellion. The provinces became a law to themselves. They armed for their own defence. They had their own little navies if they happened to be placed on the Great River or the coast. They sometimes fought for their own hand, like Hal o' the Wynd, but they would not fight for each other. How far things have changed at this present time is becoming more and more apparent. Without going so far as to say that provincial particularism is a thing of the past, we may safely declare that the growing solidarity of the country is such as most to astonish those who have lived longest in it. How it has come about is simple enough. For men to be brought together politically, industrially, or otherwise, easy means of communication are a *sine qua non*. These have to some extent been developed. We have had steam on the coast and the rivers for many years. Now there are thousands of miles of railways, and tens of thousands of miles of telegraph wires. Greater in effect even than these, there is the power of a ubiquitous newspaper press, slightly separatist at times, but as a rule tending to consolidation. Politically even greater changes have taken place. The Manchus have gone, never to return, and with them the greatest of all disruptive agencies. The first republicans, too, have disappeared to a large extent, and with them the crudest of their mistaken, if well-meant innovations. So that at the moment we see the capital and the country ruled by an administration composed of an admixture of conservative and progressive elements, precisely the kind of combination likely to commend itself to the awakened mind of a great people like the Chinese. The past is not forgotten, and the present is busily engaged in laying upon it the foundations of the future. The fear expressed by radicals that China is falling back into the slough of the past is hardly worth a thought. It is impossible for China to go back. Every token shown by recent experience points to progress. Note especially the success of such reforms as that of the Salt Gabelle. Most particularly of all, the recent financial successes should be given their full weight. The success-

ful raising of internal loans means even more in China than in other lands, and we have seen what that success has been. We have seen a reorganization of military strength, and the disappearance of rebellion before it, and last, but not least, we are now witnessing the effect of pressure by Japan. From Canton to Manchuria, from the coast to Szechuan, there are signs that China the Dispersed and Disembodied, has become China the United, a stepping-stone to China the Strong.

CURRENT MATERIAL FOR THE GEOGRAPHY TEACHER

RICE CULTIVATION IN THE UNITED STATES

Irrigation is a necessity in profitable rice culture, except in favored localities whose seasonal rainfall is very high. In general, therefore, a plentiful and easily accessible water supply is the first requisite where rice is to be grown. Rice thrives best in a warm, humid climate. A growing season of at least 135 days and a rich loam or clay soil level enough to permit economical irrigation, underlain by a tight formation through which water will not percolate readily, are other conditions only second in importance to the water supply, if the crop is to be produced on a profitable scale. These combined conditions are found in various sections along the South Atlantic coast, on the prairies of southwestern Louisiana, southeastern Texas, eastern Arkansas, and the alluvial lands along the Mississippi River and its tributaries in those States and in Mississippi.

Almost the whole of the present rice crop of the United States is grown in the sections named, although rice fields now being developed in the Sacramento Valley of California may soon add a considerable area to the acreage devoted to this crop. For many years the Carolina rice fields produced nearly all the rice grown in the United States, but the Civil War greatly injured the industry; by far the larger part of the rice crop of the United States is now produced on the prairie lands of Louisiana, Texas, and Arkansas. The industry is new in California, but promises to become of much importance in certain sections of that State, especially in the Sacramento Valley, where water is secured for irrigation by gravity flow or by pumping from streams.

In the three principal rice-growing States—Louisiana, Texas, and Arkansas—all but 2.5 per cent of the irrigated land in rice is supplied with water by pumping, and wells afford a supply for about one-third of this area. Some of the largest and best-equipped pumping plants in the world are located along the streams of southwestern Louisiana and southeastern Texas for use in rice irrigation.—[*U. S. Dept. Agr. Farmers' Bulletin 673.*]

TRAFFIC ON AMERICAN RIVERS

That river traffic in the United States is now generally local, and long runs by through fast steamers a thing of the past, is shown by an investigation of water transportation in this country which the United States Depart-

ment of Agriculture has just completed. The results of the investigation have been published under the title of "Inland Boat Service," a bulletin that deals in particular with freight rates, time of transit and length of routes.

A few hundred miles, the investigator found, is usually the maximum run for any steamboat, one of 400 miles or more being more exceptional. On only 25 of the 102 routes for which this information was available, was the average rate of speed over 10 miles an hour and on 37 it was less than six. An average of 10 or even six miles an hour amounts to 75 or 100 miles in a night's run, which is a good rate of speed for local freight traffic.

In the East, the principal routes of steamboat lines include those of the Hudson River and the Chesapeake Bay. On the Hudson there is considerable variety of traffic—through service between New York City and Albany, a number of shorter routes between various cities along this line, and, thirdly, the through traffic of canal boats carrying cargoes from the Erie Canal to tidewater. In Chesapeake Bay, traffic radiates principally from the cities of Baltimore, Washington and Norfolk. Through service between Baltimore and Norfolk, Baltimore and Philadelphia, Norfolk and Washington, and Norfolk and Richmond is maintained throughout the year.

The longest routes are to be found in the Mississippi Valley. From Cincinnati, for example, regular lines run down the Ohio and Mississippi Rivers as far as Memphis, a distance of 749 miles. Another important river port is St. Louis, from which regular lines run as far in one direction as St. Paul, on the upper Mississippi, and in another, down the river to Memphis. Other lines reach Kansas City, Peoria, Illinois, and mount the Tennessee River as far as Waterloo, Alabama. From Memphis, through boats run to Vicksburg, where they connect with boats for New Orleans.

New Orleans is the center of several important routes in addition to the direct one up to the Mississippi. One line follows the Red and Black Rivers to Harrisonburg, Louisiana, and various other routes traverse the network of rivers, bayous and canals in southern Louisiana as far west as Bayou Teche, and as far north as the Red River. There is also considerable traffic on Lake Pontchartrain.

On the Pacific Coast, an important system of waterways consists of the rivers emptying into San Francisco Bay, and here there is a rich truck region which is not conveniently reached by rail, but is comparatively easy of access by boat. San Francisco, Sacramento and Stockton are the principal centers for this traffic. A second Coast system consists of the Columbia River and its tributaries. From Portland, steamers run down the Columbia to Astoria and up as far as Celilo Falls. Above the Celilo Falls other boats reach points on the upper Columbia and Snake Rivers.—[*Commercial America*.]

THE WORLD'S FOOD HARVEST OF 1915

Much German land formerly used for pasturage, for sugar-beets, and for non-agricultural purposes, has this year been devoted to potatoes, cereals, beans, and garden crops. The total volume of food thus produced will prob-

ably prove much greater than in any former year. The same thing seems to be true of Austria. All reports from Vienna refer to the harvest season in Austria and Hungary as unusually bountiful. The very old, the very young, the women, the war prisoners, the city folks, and the soldiers on furlough have all helped in raising and harvesting the crops.

Very little information has come from France regarding current crops; but France is a farming country and ordinarily produces ample bread materials. This year's supply seems to be on a normal basis. The British Islands never produce food enough for the whole population. They will in one way or another have maintained their average this year, and Germany's submarine campaign has not impaired to any appreciable extent the facility with which England can import all that she needs from North and South America, Australasia, India, and parts of Africa. Stimulated by the high price of wheat and the European demand, American and Canadian farmers increased their acreage of cereals for this season's crop to a very marked extent. The result is that, according to the estimates of the Agricultural Department early in July, the wheat yield of the United States will be far the greatest in the history of the country, going well beyond the unprecedented crop of last year and reaching a total of almost a thousand million bushels. There were, however, in many parts of the country, very bad conditions during the period of the ripening and harvesting of the winter wheat, which will have caused a shrinkage of millions of bushels in the final outcome. In any case, the United States will have a large wheat surplus to export to Europe as needed. The Canadian wheat crop, particularly in Manitoba, Saskatchewan, and Alberta, will be harvested from a greatly increased acreage, but estimates of the total crop, as compared with that of last year, are not as yet to be regarded as sufficiently accurate for final acceptance. It is probable that the crop will go beyond two hundred million bushels, equaling that of the Dakotas and Minnesota.

There has been unwonted agricultural effort in the Empire of the Czar. The Russian wheat crop, accordingly, is reported as the greatest, both in acreage and in yield per acre, that Russia has ever known. It is presumable that rye and barley (the "black bread" cereals) are being harvested in augmented quantities. There is a large surplus of the 1914 crop in the Russian granaries and storehouses. This is partly due to the cutting off of facilities for export, and also in part to the use of the Russian railroads by the government for military purposes. This summer, large amounts will perhaps have gone out by way of Archangel and other northern ports. It is alleged that until within a few weeks past considerable quantities of Russian wheat found their way into Rumania, where they were in part transshipped to Germany.—[From "The Progress of the World," in the *American Review of Reviews* for August.]

THE MISSOURI RIVER

The Missouri is the muddiest river in the Mississippi Valley; it carries more silt than any other large river in the United States except possibly the Rio Grande and the Colorado. For every square mile of country drained it carries downstream 381 tons of dissolved and suspended matter each year. In other words, the river gathers annually from the country that it drains more than 123,000,000 tons of silt and soluble matter, some of which it distributes over the flood plains below to form productive agricultural lands, but most of which finds its way at last to the Gulf of Mexico.

It is by means of data of this kind that geologists compute the rate at which the lands are being eroded away. It has been shown that the Missouri River is lowering the surface of the land drained by it at the rate of 1 foot in 6,036 years. The surface of the United States as a whole is now being worn down at the rate of 1 foot in 9,120 years. It has been estimated that if this erosive action of the streams of the United States could have been concentrated on the Isthmus of Panama it would have dug in 73 days the canal which has just been completed, after 10 years' work, with the most powerful appliances yet devised by man.

Ten States of the Union are drained in part by Missouri River. Rising at the Red Rock Lakes, at an elevation of 6,700 feet above sea level, the Missouri descends through the Rocky Mountains and emerges onto the broad prairie lands a few miles below the city of Great Falls, Mont. Within 10 miles of Great Falls there are five great drops of the river and an aggregate fall of 612 feet. From this point it is accounted a navigable stream with an easy grade, and in passing through the Dakotas and along the borders of Nebraska, Kansas, and Iowa it receives the flow of great tributaries, so that as it crosses the State of Missouri and joins the Mississippi a short distance above St. Louis it becomes one of the large rivers of the world. Its total drainage area is about 492,000 square miles in extent.

On Shoshone River, in Wyoming, a tributary of the Bighorn, which in turn is tributary to the Yellowstone, is located the Shoshone dam, one of the highest of its kind in the world, 328 feet from foundation to capstone. This structure was erected by the Government to impound water for irrigation on the arid lands in the valley of Shoshone River below. Another great structure of a similar kind is located in Wyoming, on North Platte River, which joins the Missouri near Omaha, Nebr. This is known as the Pathfinder dam, and was also erected by the Government to impound water for use in the irrigation of lands in Wyoming and Nebraska. Another notable engineering structure in the drainage basin of Missouri River is the Belle Fourche dam, erected across the river of the same name in South Dakota by the Government to impound water for irrigation. This dam is an earth embankment 155 feet high and 1 1-5 miles long, containing 1,600,000 cubic yards of earth fill. This is one of the greatest earth dams in existence.

NEWS NOTES

One hundred and fifty persons, mostly teachers, were enrolled in the geography courses at the summer session of the University of Wisconsin.

On July first Professor Isaiah Bowman assumed his duties as Director of the American Geographical Society of New York. He also holds the position of Librarian of the society.

Professor N. A. Bengtson's paper on "The Influence of the Transcontinental Highways of the United States on the Price of Wheat," read before the Chicago meeting of the Association of American Geographers, appeared in the June number of *School Science and Mathematics* (Chicago).

One of our former contributing editors, Dr. Charles McMurry, has resigned from his dual position as Superintendent of Schools of DeKalb, Ill., and professor of pedagogy in the state normal school of that city, to accept a new position in the Peabody Teachers' College of Nashville, Tenn.

Mr. V. C. Finch, business manager of the *Journal of Geography*, who has been absent from the University of Wisconsin for several months, engaged in work on the U. S. Dept. of Agriculture's forth-coming "Atlas of Agricultural Geography," will return to his work in the university in September.

E. V. Robinson, professor of Economics, University of Minnesota, has returned from a year of residence and travel in Europe. During his absence he was elected to a professorship of economics in Columbia University, New York.

Mr. George B. Roorbach of the University of Pennsylvania, editor of the *Bulletin of the Philadelphia Geographical Society*, is in Venezuela making a study of the effects of the European war on industrial and commercial conditions in that country. The investigation is being conducted under the auspices of the Carnegie Endowment for the Promotion of International Peace.

The July *National Geographic Magazine* contains a large folded map of Europe, in colors. The magazine's recent practice of including large maps in colors is to be commended. The July number of the *Bulletin of the American Geographical Society* also contains a large folded map in colors,—in this case, of a portion of the Canadian Rockies. The geographical magazines in America are rapidly rising to the high standard attained by the best European magazines. No European magazine compares with the *National Geographic* in excellence of illustrations, but in the average quality of the geographical

papers the best European magazines are still superior to ours. We know of no European magazine, however, which has a department of "Geographical Literature and Maps" equal to that of the *Bulletin of the American Geographical Society*.

Dr. Wellington Jones and Mr. Carl O. Sauer of the University of Chicago published a valuable "Outline for Field Work in Geography" in the July number of the *Bulletin of the American Geographical Society* (New York). The outline presents the plan under four main heads:

1. Preparation for field work
2. Field methods
3. Field observations
4. Office work after the field season preliminary to writing report.

An important contribution to the science of glacial geology, one of a series of similar reports, is Monograph 53 of the United States Geological Survey, "The Pleistocene of Indiana and Michigan and the History of the Great Lakes," by Frank Leverett and Frank B. Taylor. In this report the authors have continued the description of the glacial deposits and history of the Great Lakes region. Their maps show the relations of the remarkable systems of moraines formed by the glacial lobes which occupied the basins of Lake Michigan, Lake Huron, and Lake Erie.

The Geological Survey has unearthed some copies of the "Catalogue and index of the publications of the Hayden, King, Powell, and Wheeler surveys," the four great Federal surveys whose field work was carried on between 1867 and 1879, when the United States Geological Survey was organized. The publications of these early Government organizations constitute a storehouse of geographic, geologic, ethnologic, and archeologic information concerning the western portion of the United States. The Geological Survey has no copies of the publications of these surveys for distribution, but the index (Bulletin 222) may be obtained on application to the Director, U. S. Geological Survey, Washington, D. C.

RECENT PUBLICATIONS

PRACTICAL EXERCISES IN GEOGRAPHY, by Wm. J. Sutherland and Chester M. Sanford. Silver, Burdette and Co., 196 pp. 1915.

The authors are respectively the president and the head of the department of geography of the Platteville, Wis., Normal School. In this little book, the authors put into concrete form, some of the ideas which President Sutherland has championed in various addresses and papers. The book is based upon the idea that geography in the upper grammar grades is most effectively and most interestingly taught through practical exercises or elemen-

tary laboratory problems to be worked out by the pupils. A text book, reference books, and a note book are required. Book I, which deals with the United States, is to be followed by Book II, dealing with South America and Eurasia. The character of the "problems" is suggested by the following: Why should factories be located at waterfalls? What influence have the rivers of New England had on the development of manufactures? Why is fishing profitable off the coast of New England? Why has fruit growing become the leading industry of Florida? Why is rainfall so meager on the Great Plains west of the 100th meridian? Besides the problems which are to be solved by working up the answers to a series of questions, the book contains text material, general questions and page references to a large number of reference books.

That the authors of this book, both experienced teachers of geography, are working out a highly valuable method of teaching the subject, there is not the least doubt. Every teacher knows that the ordinary text book method of teaching geography has not given results. The laboratory method has been introduced in some high schools and universities with varying degrees of success. Here is an attempt to apply the laboratory method to the grade work. The little book is a praiseworthy endeavor, worked out with thought and good judgment. It deserves to succeed. We shall be much interested to receive reports from teachers who try the method and we hope many will make the trial.

NEW TRANSCONTINENTAL GUIDE-BOOKS

THE United States Geological Survey has recently issued a guidebook describing the Overland Route from Missouri River to the Pacific coast, and every traveler may now enjoy the luxury of being "personally conducted" without any other expense than the dollar he must send to the Superintendent of Documents at Washington, D. C., to obtain a copy. Similar guide books covering the Northern Pacific Route, so closely identified with the Lewis and Clark expedition of 1803-1806, the Santa Fe Route and the Shasta and Coast Route are to follow soon*.

The value of these guides to travelers interested in their country can not be measured. The route is followed from station to station, and the country along the way described and explained from many points of view. Human history, geologic history, agricultural and mining values—everything, in short, that can make a car-window landscape vital and interesting—is succinctly and rapidly sketched. The long stretches of prairie country and endless miles of desert, often so dreary to the uninformed traveler, are made to teem with human interest and scientific information.

The guidebooks are full of items of general interest that will answer such questions as the average intelligent traveler is continually asking. In a broad way the story of the West is a unit, and the aim of this description of

*The Northern Pacific Guide Book and The Traveler's Guide to the Pacific Coast, covering the Shasta Route and Coast Line are now ready for distribution. \$1.00 each, Supt. of Documents, Washington, D. C.

the western United States is to meet the needs of the American citizen who desires to understand what he sees.

In the preparation of the book on the Overland Route (Bulletin 612) much information already in the possession of the Geological Survey has been utilized, but to supplement this material three geologists last year made a field examination of the entire route, while special topographic surveys for the accompanying maps were made by Survey engineers. The route is covered by a series of 29 complete and accurate maps, which are so arranged that the reader can unfold them one by one and keep each map in view while he is reading the text relating to the portion of the route it represents.

The book is also freely illustrated with half-tone plates of some of the most striking views and objects to be seen on the journey and with pictures of prehistoric animals that inhabited the West in ages past, when Nebraska and Colorado, for instance, were huge swamps frequented by strange beasts whose fossil remains are now found in the rocks formed from the sand and mud of the ancient swamps, which have since been elevated thousands of feet. The book of 244 pages is as a whole distinctly popular in character. Price \$1.00.

LASSEN PEAK BELIEVED TO HAVE SPENT MOST OF ITS ENERGY

LASSEN volcano, California, spent most of its energy in its violent eruptions of last May, according to reports received by the Forest Service, and it is believed that there is little likelihood of further destructive outbreaks. Since the upheavals of May 20 and 22, the volcano has been under the observation of officers of the Lassen National Forest, in which the peak stands, and for the last month a volcanologist of the U. S. Geological Survey has been making a scientific study of the mountain.

The investigations have confirmed the opinion that the eruption of two months ago, when a river of mud was blown out of the north side of the crater and down Hat Creek with considerable damage to Government and private property, was caused by the melting of the snow on the peak, the snow water running into the crater and being converted by the molten lava into steam. Although it is possible that the volcano is simply conserving its energy for another outbreak, the indications are, according to the Government volcanologist on the ground, that no further eruptions are likely to occur, at least until next spring when another influx of snow water may cause a slight disturbance.

The first authentic report of the damage done by the eruptions of last May shows that early reports were greatly exaggerated.

MISCELLANEOUS "WHYS" IN GEOGRAPHY

1. Why do we have alternate day and night?
2. Why do we have change of seasons?
3. Why are there ocean currents?
4. Why are there tides?
5. Why does it rain?
6. Why are there caves?
7. Why are nearly all caves in limestone?
8. Why do rivers flow down hill?
9. Why does dew form in summer nights?
10. Why do clouds gather in the sky?
11. Why is the torrid zone 47° wide?
12. Why is it cold at the poles?
13. Why has the year $365 +$ days?
14. Why does sinking of the land give an irregular coast?
15. Why are lakes common in most glaciated regions?
16. Why are lakes in stream courses an evidence of youth?
17. Why is the soil usually better in valleys than on hill slopes?
18. Why do the rocks weather more rapidly in mountains than elsewhere?
19. Why are waterfalls in streams an evidence of youth?
20. Why is the bed of the ocean less irregular than the surface of the continents?
21. Why do high mountains cause rainfall?
22. Why is the temperate zone 43° wide?
23. Why do sand-bars form in rivers?
24. Why do they form along some sea coasts?
25. Why are there glaciers in some mountains?
26. Why do glaciers move?
27. Why do rocks decay?
28. Why are flood plains usually fertile?
29. Why do some rivers build deltas?
30. Why do rivers make valleys?
31. Why is an oceanic climate more equable than a continental?
32. Why is a "southern exposure" in our latitude warmer than a northern?
33. Why are the days and nights of equal length over all the earth at the equinoxes?
34. Why does the sun appear to rise in the east?
35. Why is the atmosphere denser at the base of a mountain than at the top?
36. Why does the torrid zone not have seasons like ours?
37. Why is it possible for us to have our winter when the earth is nearest the sun?
38. Why do the equatorial currents of the oceans move toward the west?

NEW AND FORTHCOMING GEOGRAPHICAL MATERIAL

Henry Holt and Co. announce the publication in the near future of a high school Commercial Geography written by Prof. J. Russell Smith of the University of Pennsylvania.

A Brief Laboratory Course in Physical Geography, by Everly, Blount, and Walton, has just been issued by the American Book Co. It is a revision of the earlier manual by the same authors; loose leaf; adapted to a half-year course in high school.

A New Rainfall map of the United States (62x42 inches) has recently been issued by A. J. Nystrom & Co. (Chicago). It is based upon data prepared by Mr. Henry Gannett, shortly before his death. Seven different degrees of rainfall are shown by shades of blue. The same publishers also announce the publication of the Kuhnert Relief-like map of the United States (75x65 inches). This map was printed in Germany but edited in America. It forms one of the Kuhnert Relief-like map series.

A new rainfall map of the United States, by Eugene C. VanCleaf, has recently been issued by Rand McNally and Co. (Chicago); size 44x66 inches. The same publishers are announcing a new political map of South America and a new physical map of the world on the Mercator projection, by Professor J. Paul Goode. In the latter map altitudes of 1000, 2000, 5000 and 10,000 feet are shown by differences in coloring. Ocean depths, isotherms, ocean currents, and cities of over 500,000 population are shown.

"Panama and its Bridge of Water," a Geographical Reader by Stella H. Nida. "South America," a Geographical Reader by Professor Iasiah Bowman, and a "True Literary Map of the British Isles," (46" x 66") prepared by Blanche L. True, are among the new offerings of Rand, McNally and Co.

The Geological and Natural History Survey of Wisconsin has recently issued—

"Limestone Road Materials of Wisconsin," Bulletin XXXIV, by W. O. Hotchkiss and Edward Steidtmann.

"Mineral Lands of Northern Wisconsin," Bulletin XLIV, by W. O. Hotchkiss, E. F. Bean and E. O. Wheelwright.

"Peat Resources of Wisconsin," Bulletin XLV, by F. W. Huels.

Two additional Bulletins will soon appear: "The Geography of the Fox-Winnebago Valley," by R. H. Whitbeck, and "The Physical Geography of Wisconsin," by Lawrence Martin.

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GROWTH OF GREAT CITIES

By Frederick Homburg
Woodward High School, Cincinnati

THE ORIGIN OF CITIES

WHO, according to the Bible, was the founder of cities? It was Cain, the tiller of the soil, not Abel the herdsman. Why should the herder, in the midst of the roving life of a nomad, suddenly get the notion of settling down in community life, which would involve curtailment of his accustomed freedom? In ascribing to the agriculturist the founding of the first city, Semitic tradition is undoubtedly correct, however strange and paradoxical that seems; paradoxical, because the contrast between city and country is growing more and more pronounced; strange, because we are not apt to think of Jews as farmers. We must remember that cities at the beginnings of civilization were not cities as we know them; they were not centers of industry and commerce, but places of refuge of a rural population. Those ancient towns were enclosures with walls, preferably on heights or near waters, so as to give the insiders every advantage in defense. In times of danger the country people on a considerable area would drive their herds and carry their chattels into these enclosures, and as soon as the danger was passed, they would return to their fields. After a while such a fortification became the gathering place not only when enemies were near, but also for celebrations, festivals, and religious courses; and thus in time it became the permanent abode of a number of people. "Safety first" is a modern slogan, but the principle is an old, and, in the early days, a most necessary one.

The Roman, or perhaps better called the Etruscan, rite of founding a city substantiates Hebrew tradition. According to this sacred custom, a yoke of oxen was hitched to a plow and a furrow was drawn to mark the place for the protecting wall. Where a gate was to be built, the plow was lifted and carried—*portare*, to carry—hence the city gates were the portals. Who but a cultivator of the soil would have thought of drawing a line with a plow, and who but those that needed protection above everything else would have set limits and erected a wall about an empty expanse? Suppose merchants had founded the early cities; would they have fixed the bounding line first? Would they not rather have thought first of a market place as a commercial center, and built outward, with streets for travel and transportation and structures for dwelling and storing? Now, of course, the unyielding and confining girdles have usually been removed, and what was at first incidental has become of prime importance, viz., buildings, squares, and streets. At first, however, pro-

tection was the motive, and here again we have confirmed the contention that the first city builders were farmers. In the plains of Mesopotamia and in the Nile valley, agriculture was first developed, and it was there that the early great cities grew. In those open plains, artificial defenses were needed, hence fortresses—or cities if you please—were founded. The original walls after a time were unable to hold the increasing population, and a lower or outer town began expanding about the ramparts, surrounding them as an acropolis. Thus Carthage grew about the Byrsa which Dido had founded; and Rome spread out beyond the Palatine, and the various walls mark epochs in the development of the Eternal City. The names of many old towns refer to the old fortifications. Think of the number of towns in Germany with the final syllable—*burg*; thus, Hamburg, Augsburg, Magdeburg, Weissenburg, Rothenburg, etc. Now *burg* or *burgh* or *borough* means a corporate town; a burgher is a citizen; yet originally a burg was a castle. *Castrum* denoted a Roman military camp, and because people flocked there for protection,—and that was particularly the case in the border provinces—such *castra* became the nuclei of towns; thus we have the names Manchester, Colchester, Gloucester, Leicester, Lancaster, etc., to remind us of the old defenses. The Arabic *El-Kasr* and the Spanish *Alcazar* are similar terms.

PROGRESSIVE CHANGE IN CHARACTER

As long as protection was the main function of towns, there was little difference between them except in size. In our day towns in barbarous or semi-barbarous countries, which are deemed important enough to be marked on the map, are simply more populous, but in no way more advanced, than the humble villages which exist unrecorded. Without increasing division of labor and improvement in commerce, we have simply large villages but no cities. To this day we see in the village towns of Hungary and Russia rural communities, the members of which live by tilling the neighboring land. The founders of towns had to look to immediate advantages; good building site, good building materials, good water supply, etc. Sometimes they builded better than they knew, or else we must credit them with keenness of prevision. The combination of a number of favorable factors was necessary for continuance and growth. Some settlements have had a remarkably long life. Archaeologists have shown that in the ruins of Hissarlik, which Schliemann proved to be the site of ancient Troy, are the remains of a town which flourished from 3000 B. C. to 500 A. D. Constantinople, the ancient Byzantium, has lasted for ages; of all the Alexandrias founded by Alexander the Great, the one that has endured is in the Nile delta; Marseilles, (the Massilia of the Greeks), has always been important as the gateway of the Rhone valley; and Rome seems not inaptly to be called the Eternal City.

THE IMPORTANCE OF TRANSPORT FACILITIES

No one would expect to find a great city at high altitudes or on an islet in mid-ocean. Among the conditions favoring city growth, ease of communi-

cation stands first. Without transportation facilities, how could the needs of a large population be supplied? The amount of food-stuffs annually required by a large city is almost past belief. Adam Smith asserts that the surplus of the country supplies the needs of a city, and that therefore the growth of cities will be proportional to this surplus. If by country we mean the surrounding land, this dictum would apply simply to the towns of ancient and medieval times; but modern means of transportation have made cities independent of their immediate environment by enormously enlarging the area to be drawn upon, and therefore growth may continue unlimited except by transportation facilities.

GREAT CITIES OF THE ANCIENT WORLD WERE POLITICAL CENTERS

In ancient times large cities were political centers; thus Nineveh and Babylon, Thebes and Memphis, flourished in the days of power of their states and then declined. These cities represented the concentrated power and progress of the state; indeed anciently the words city and state were often synonymous (the term city-state is applicable), and the conquest of the former meant destruction of the latter.

ANCIENT ROME

Of all the large cities of ancient days, the one that comes nearest our modern idea of big cities is Rome. Rome had overlaid the whole of Italy with a network of excellent roads, and it was situated on the Tiber near the sea; but above all, it was the capital of a world empire. All roads led to Rome, and the whole civilized world was tributary to it. The impression of the life in its streets, this jostling of a populace derived from all quarters of the then-known world, the rush and bustle of a world-mart must have been indescribable. One must have felt the beating of the heart of the world in the midst of a community formed of a union of all nations. The ear was bewildered by the uncouth sounds of a hundred tongues, the eye by the forms and colors of all races, and the costumes of all peoples. The vast majority of the citizens were fed wholly or partly at the expense of the state; and the rich and great, the purse-proud from everywhere, could display their wealth nowhere to greater advantage than at Rome. Is it a matter of wonder, then, that the offscourings of all nations made the capital their goal, and that the Roman mob was peculiarly dangerous, doubly so because of its idleness? Since by large and regular distributions of grain the government had undertaken the feeding of the mob, it was compelled to take upon itself the burden of its entertainment. Games, which even in the latter days of the Republic had been the surest means of winning popular favor, had to be used by the emperors to keep the crowd in good humor. So it happened that bread and games were regarded not as a favor of the government but as a right of the mob; and even the good emperors did not dare to turn a deaf ear to the cry "Panem et Circenses!" Such conditions, bringing together the idle rich and the idle poor, are unique in history.

But when the emperor Constantine removed the seat of government to Byzantium, which thereafter was known as Constantinople, the decay of Rome, which had long been preparing, became frightfully evident. The barbarian inroads did the rest. In early medieval times stillness reigned on the Seven Hills, and the Roman forum was called *Campo Vaccino*, and rightly so, for it was a mere cow-pasture. But Rome conquered the world twice: once with the sword and then with the cross; and crowds of devout pilgrims brought life and wealth to the banks of the Tiber. Again Rome declined when under French pressure the Papal court was removed for a time to Avignon; but in our day a great revival has taken place by Rome's becoming the capital of united Italy.

COSMOPOLITAN CHARACTER OF AMERICAN CITIES

Many modern cities far exceed ancient Rome in population and are nearly as cosmopolitan as far as its composition is concerned. Without exaggeration we may say of New York that besides being the greatest American city, it is an Irish city far ahead of Cork (hence the suggestion to change Y to C); it is a German city much greater than Frankfurt on the Main; an English city fully equal to Southampton and Plymouth combined; a Jewish city far more populous than Jerusalem in its palmiest days; an Italian city which outnumbers Venice, and a Russian city much larger than Astrachan. While the number of Chinese is considerable, relatively it is not large and does not invite comparison; but the negroes are numerous enough to fill thousands of kraals in Central Africa. Truly Zangwill was right when he called this the melting-pot.

Let us look at the American city next in size from another viewpoint. At Chicago the atmosphere vibrates to the sound of about 40 different languages; periodicals are printed in 10 languages; and 20 languages—of which however at least two (Latin and Hebrew) are called dead—are employed in religious services.

THE MODERN CITY

The growth of big cities other than centers of power is an altogether modern phenomenon, and is based on wholesale industry and commerce of world-wide extent. Especially in the last generation have the big cities increased in number and in size. Nowadays cities may arise in districts unable adequately to feed them. The whole world is drawn upon to furnish food for London: grain and flour are imported from America, Russia, the Danubian countries, and India; the United States, Argentina, and Australia furnish meat; eggs come from France, Germany, and Russia; butter is supplied by Denmark, the Netherlands, Australia, and New Zealand; fresh fruit is sent by France, Spain, Italy, and even California. Thus the big city becomes independent of its neighborhood and depends more and more on imports. Such conditions make it possible for a city to develop in a region where, hitherto, the merest village could not have existed. Thus Coolgardie and Kalgoorlie,

of whose existence most people are innocent, and which in spite of their queer names are thriving towns, have shot up mushroom-like near the West Australian gold fields in an absolute desert. What a contrast! The cosmopolitan life and modern comforts in the business section, then a view from a tower out on the dreary expanse around! You realize in spite of your modern surroundings that you are in "the land of sin, of sun, of sand, of sweat, of salt, of sorrow and of sore eyes." What has wrought this miracle? An enormous pipe line which conveys the much-needed water from the distant Darling Mountains, and the railway which brings supplies from Perth on the coast.

Rapid transit which made the big city possible has also caused a specialization in its growth. Trade and industry are concentrated at the center where in day-time there is a congestion of human and mechanical activity, while the same locality is still and deserted by night. The buildings here are not dwelling places, but factories, elevators, storehouses, sales-rooms, and office structures. Here is the ground favorable to the growth of sky-scrapers, which are giving the business section of many American cities a characteristic skyline: the tendency to build in a vertical direction grows with the cost of the building site.

Labor and exchange go on in the city proper, the business center, while dwelling houses are erected at the periphery. Here we have centralization of one kind and expansion of another. Thus the city invades the country; but modern conveyances bring the suburbs close to the center. As far as habitation is concerned, the city is, as it were, hollowed out; a populated circumference about an empty center. As to movement of the inhabitants there is a centripetal influence in the morning, a centrifugal tendency toward night; again early in the evening there is an inward surge to places of amusement and a counter-current late at night. Where are the big cities found? Take an outline map and mark the big cities and their number of inhabitants; mark also the number of inhabitants of the countries or sections of countries where they are located and the density of population of those areas. Then compare England or the Netherlands with Russia, India with Siberia, West Russia with East Russia, the Rhine province of Germany with Mecklenburg, the eastern part of the United States with the West. It will be found that the most densely populated regions have the greatest number of cities and the largest cities. It may be stated as a rule that the denser the population, the higher is the percentage of city dwellers. There is no rule without exception, and Australia is a notable one. The map study will also show, as is implied above, that the earth's surface is differentiated into densely and sparsely-populated areas, and that the density of population is greater in industrial and commercial regions, less in agricultural districts and least where the surface is too rugged or too dry or where heat or cold is extreme. That means the big cities are in favorable situations in the temperate zone. Exceptionally, improved means of transportation have rendered possible the growth of large cities under very unfavorable conditions; and this very fact makes strikingly evident that cities are the most artificial objects of geographical study. Two

movements of population are characteristic of the present time; one is from old and densely populated countries to newly developed and thinly settled parts, the other is from the country to the city. If you watch the stream of immigrants at Ellis Island, the former kind of migration may be more apparent, yet the second kind, though less obtrusive, has been far steadier and much more general. Big cities have grown not from within by a prodigious birth-rate and a low death-rate, but from without by accretion. A law similar to that of gravitation might be formulated for the attraction of great cities.

THE CITY AND THE COUNTRY

By high pressure industry and a world-wide commerce, the city serves the important function of giving employment to the surplus population of the country. Agricultural machines and labor-saving devices of all kinds have rendered unnecessary much of the labor once required in farming. But when it is difficult to bring in the harvest, when necessary hands cannot be hired in the country, when neglected and deserted farms proclaim a retrogression of agriculture, then the cityward trend becomes alarming. No wonder that there is a "back to farm" agitation here and elsewhere. Special study and attention is given to the betterment of conditions of rural life; agricultural colleges are exerting their influence; and farmers' institutes, rural social surveys, efforts of railroads, industrial corporations, and bankers' organizations, the offering of agricultural courses even in large city high schools, all give evidence of the wish to stem the tide.

In the complex life of modern times, the city is a necessary and important factor. The number and size of its cities may be taken as a gauge of the advance of a nation; and no part is more sensitive in responding to the ebb and flow of its prosperity. That the city growth has at times been inordinate and unhealthy is unfortunate for both city and country.

In the discussions of the cityward movement there have been bitter partisan expressions. No doubt it is true that agriculture is the source of civilization, and that it feeds industry and trade, the arts and the sciences; and the saying of Frederick the Great still holds that "agriculture is the first of all arts; without it there would be no merchants, no poets, no philosophers; and only that is true wealth that is produced by the earth." But it is not true that our large cities are economically passive, non-producing, and strongly consuming parts of the social organization; on the contrary they are the scenes of greatest activity, most concentrated, specialized work, and most intense production. By a process of social selection the big cities display the greatest mental and economic energy; and in the modern march of progress, they are the standard bearers.

OVERLOOKED BOHEMIA

By Eugene Van Cleef
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SINCE the beginning of the European conflict essentially nothing has been said about Bohemia, for it is only one of the several provinces of the dual kingdom, Austria-Hungary. Even during times of peace little mention has been made of this important garden of central Europe. As a matter of fact it constitutes a physical unit that has played a most significant role in the shaping of the countries of Europe; it will undoubtedly come upon the stage once more to play perhaps an equally important part. In view of these conditions, a few observations with some conclusions, all briefly considered, may prove worth while.



Fig. I.—Map of Bohemia, showing the Distribution of Germans and Czechs. After Hettner-Landerkunde Europa.

Location.—Bohemia lies almost exactly half way between the Adriatic Sea and the Baltic. The city of Prag*, almost in its exact center is practically midway between the meridian of 0° passing through London (Greenwich) and the meridian of 30°E. on which Petrograd lies. One of the great arteries of transcontinental trade connecting the North Sea and the Black Sea makes a pathway through central Bohemia. So far as centrality is concerned the province could hardly be better located.

Surface.—Its area (20,065 sq. miles) is less than half that of New York State. It is not however so nearly a plain. Almost the entire surface possesses considerable relief. Only along the southeastern boundary line is the otherwise continuous mountain girdle broken. The Risengebirge along the northeast boundary, the Erzgebirge along the northwest, and the Bohemian Forest along the southwest, are well defined ranges with a maximum altitude

*The spelling used by the citizens of Prag will be adopted here instead of the Anglicized form Prague.

in the Riesengebirge of about 5300 feet (the Schneekoppe). The average heights range much closer to 2000—3000 feet. The Bohemian-Moravian hills along the southeast include a considerably dissected upland of approximately 1000 feet elevation. These mountains are of igneous origin while those in the interior through which the Elbe has cut its valley are recently-formed sedimentary rocks. All of the rocks of Bohemia have weathered into fertile soils at their surfaces.

Climate.—The climate in many respects approaches the ideal. Summers are warm but not excessively hot, while winters are cool but not extremely so. The temperatures for Prag, which may be taken as fairly representative of the interior, range from about 30°F. in January to 68°F. in July. Of course as one ascends the highlands the temperatures will lower. A few of the mountain tops, especially in the Riesengebirge, are covered with dome snow the larger part of the year. The annual rainfall in the central portion is about 19.6" which increases to as high as 50" toward the surrounding mountain summits.*

Agriculture.—Such a continental climate combined with the remarkable fertility of the soil gives to Bohemia an agricultural resource that many a country would gladly cherish. Among the numerous crops are hops, potatoes, sugar-beets; small fruits, such as grapes, cherries, apples, and plums. Most of the grains are represented, principally wheat, rye, and flax. Geese, cattle, and swine are the most important farm animals. Although most of the crops are grown everywhere, some of the sections have become especially noted for certain crops. Melnik, on the Elbe, is the vineyard center; Saaz on the Eger is noted for its hops, large quantities of which find their way to America. The villages south of Prag rank first as owners of geese. The valley of the Elbe, particularly in the neighborhood of Kralup, is the sugar-beet center.

Although orchards occur frequently, a very considerable portion of the fruit crop is grown along the roadways. Cherry, plum, and apple trees are utilized as shade trees thereby serving an efficient double purpose. Recognition of strictly enforced laws saves these crops from the fate they usually suffer in our country when so publicly exposed. Nearly one-third of the land is in possession of large landholders, usually of title. As a result forest preserves are still extensive—not entirely to the best interests of the masses.

Minerals.—Bohemia's mineral resources also rank high. With the exception of salt, probably no mineral is lacking in her numerous hills. Coal, particularly lignite (Braunkohle), is in abundance, especially in the Eger valley near its junction with the Elbe. Iron, and coal (mostly anthracite), occur in quantity in the region about Pilsen. Silver, lead, garnets, copper, nickel, cobalt, kaolin, quartz from which glass sand is derived, tungsten, tin, and alum make a rather formidable array of minerals, a complete list of which would be too long to detail here.

*It will be necessary here to omit the remaining climatic elements.

Communications.—The break through the Erzgebirge in northeastern Bohemia is the "Iron Gate" of the Elbe. Here lies the single easy entrance to Bohemia from the north. Though the Erzgebirge are not high, only occasionally reaching 4000 feet, their inner or Bohemian slope is very abrupt and hence traversed with difficulty. Thus the route of the Elbe becomes at once an important highway. The Germans filter through and the Bohemians occasionally wander out. The result is a mixture of peoples in Bohemia.

People.—The inhabitants are divided into German Bohemians, many of them pure Germans, and Czechs. The word "German" is prefixed before "Bohemians" because the German of Bohemia exhibits somewhat different characteristics from his brother in Germany. About one-third of the 6,769,548 people is German and the remainder Czech. Along the west bank of the Elbe for considerable distances north of Prag, Czech towns predominate; along the east bank German towns. In nearly all of the cities both German and Czech schools are represented. But such antipathy has developed between them that the respective masses refuse to use each other's language or to even acknowledge that they understand one another.

Cities.—The industrial centers of the mountain areas with the exception of the southeastern districts, are occupied by the Germans (see Fig. 1). Mining at the foot of the Erzgebirge and cotton, wool, linen, and glass manufacturing are very largely under German control. The culmination of German industry in this foreign land is perhaps best appreciated in Reichenberg (pop. 35,000) located on the Neiss River where it controls the important pass leading to Saxony and Silesia. In Reichenberg the struggle between German and Czech has reached serious proportions only lately, with the former however still holding the upper hand. Prag (pop. 541,000) the capital city and a growing industrial center, has not been able to maintain itself as a German city. It is a pure Czech town today, although 50 years ago it was not so. Now only one-sixth of its population is German.

Other towns of importance that might be mentioned in passing are Aussig (pop. 40,000), a river harbor on the Elbe for the distribution of lignite and a limited quantity of lumber; Pilsen (pop. 80,000) in the west on the Beraun River, the city which has given the world-renowned name to "Pilsener" beer. In the southern part of the country on the upper Moldau, in control of the important road to Linz on the Danube, lies the rival city of Budweis (pop. 45,000), whose name also is well known. Large cities are generally absent. On the other hand the many small cities give a relatively even distribution of population. It is probable that the occurrence of minerals in nearly all parts coupled with highly fertile lands everywhere conduces to this distribution.

History.—Bohemia was first invaded by a tribe of Kelts called *Bojern*, from whom it seems the province derived its name. The territory was organized into a province about the 10th century and ruled by the dukes of the House of Premysl, who in turn acknowledged control by the kings of German territory. The beginning of the Thirty Years' War in 1618 was the result

of Bohemian resistance to Hapsburg rule. This proved for a while a serious menace to the Germans. The revolt however failed so far as Bohemia's aspirations were concerned.

In 1848 insurrection was again the rule. The Czechs demanded that their language be given the same recognition as the German in the courts of Vienna. A Pan-Slavic Congress was called attended by Czechs, Moravians, Ruthenians, Servians, and Croatsians. During the first few days a local insurrection brought out the Austrian army and resulted in the breaking up of the Congress and the establishment of a military government. The hopes for Bohemian independence were again crushed.

Present Conditions.—It is clear that the Germans have had a vital interest in Bohemian territory. When the alliance of Germany with Austria-Hungary was effected it seems hardly possible that it was for purely military purposes. Economic reasons were probably equally as potent. Germany's limited agricultural resources, as is generally known, have necessitated large importations of foodstuffs. Quite in contrast Bohemia can easily raise sufficient for her people. In fact she has a surplus which Germany can well utilize. With the realization that in war times it might be possible to cut off food importations, an alliance with Austria would insure a source of supply sufficient to save her from disaster, temporarily at least.

While the facts are not available to the writer, it seems more than probable that the remarkable endurance shown by Germany in the present war is in no small degree due to the alliance with Bohemia (that is, Bohemia as a part of Austria). Naturally the Austrian armies need supplies too and are drawing upon the same source. But when it is realized that food "goes much further" in war times, the presence of Austria in the ranks still allows of some supplies for Germany. It has been admitted, with reluctance, by some who are in a position to know, that although Bohemia is a physical unit Germany would enjoy very much having her as a part of the empire.

Riding through Bohemia one observes green fields everywhere. The tracts are not large to be sure, but there are many of them. The density of population does not permit of such bonanza farms as in our country. Cultivation is entirely intensive. Probably no part of continental Europe is more productive both of foodstuffs and minerals than Bohemia. No section contiguous to Germany could be more valuable. Yet perhaps no territory upon her boundary line is more nearly a perfect physical unit.

Bohemia has not yet been developed to its limit of possibilities. It has tremendous opportunities. But as long as Czech opposes German and militarism opposes Czech there can be but little more progress than the past few years have seen. As a physical unit and therefor logically a potential political unit, Bohemia should eventually become an independent country.

HARBORS OF SOUTH AMERICA

By Henry F. James
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THE prosperity of some countries depends largely on commerce. Modern commerce depends much on the ocean highways, but owes its rapid development in part to favorable coast lines and harbors through which access to the sea is secured. Countries with an unfavorable sea-coast like Russia, or with a small extent of coast line, like Austria, are handicapped when compared with a country like the United States with fairly good coasts on three sides.

CHARACTERISTICS OF A GOOD HARBOR

(1) A good harbor must first of all afford shelter from stormy seas, must be deep enough for large vessels to reach the piers, must be connected with the open ocean by a deep channel, and must provide ample room for the anchorage of many ships.

(2) It must have convenient internal routes to a rich hinterland, one that is a large producing or consuming region or both. Harbors at the mouths of large rivers are likely to have easy communication with the interior by means of river navigation, and the valleys are natural routes for railways.

(3) It must be in the hands of a far-sighted government, for few harbors are naturally suited to all the demands of present-day commerce, and it is necessary for vast expenditures to be made before they are entirely suitable.

GENERAL FEATURES OF THE COAST

South America is very dependent upon the sea for means of communication; however, it is poorly endowed with harbors. The indentations of its shore line afford surprisingly few natural harbors capable of affording safe and accessible havens for maritime trade without enormous outlays in protective works and docks. Seaports, such as exist in Europe and North America, deeply indented and well sheltered are rare, and the heavy outlay for harbor works forms one of the most serious items in the budgets of the South American Republics. On both coasts, yellow fever, plague, smallpox, and malaria, have been a scourge for centuries. However, it is shown that these scourges are the result of human negligence rather than of uncontrollable natural conditions. Added to these are the earthquake and tidal wave, which so frequently occur on the western side of the continent in the past and may occur at any time.

SOUTH AMERICAN RIVERS

The important navigable rivers of South America are confined to the Atlantic and Caribbean slopes. The Pacific slope rivers of Chile and Peru are mainly of value for irrigation.

It is upon the Amazon and its great stretches of navigable waterway, the Rio de la Plata and its tributaries, and the Orinoco and the Magdalena on the north, that the continent depends for its natural means of communication.

The Amazon.—The main trunk of the Amazon is four thousand miles in length, navigable for ocean steamers for nearly 3,000 miles from its mouth, and, with its branches, affording 25,000 miles of navigable water.

The La Plata.—The La Plata system is scarcely less useful; the Parana is navigable for vessels of 12 feet draught as far as the city of Parana, 300 miles above Buenos Aires; and to Rosario, 185 miles above Buenos Aires, for vessels of 15 feet draught; above Parana the river is navigable for vessels drawing ten feet of water as far as Asuncion, 970 miles above Buenos Aires. Portions of river still farther up are navigable for smaller craft.

The Orinoco.—The Orinoco is navigable for large steamers of stern-wheel type throughout the year to Ciudad Bolivar, a town some 375 miles from its mouth.

WESTERN SOUTH AMERICA

The Pacific coast line is about 4500 miles long; it has few good harbors and has very difficult communication with the interior. The principal ports are Guayaquil, Callao, Valparaiso, Iquique, and Esmeraldas.

Colombia's Pacific coast line has a length of about 500 miles; it has been of slight service in the development of the country, because of the unsettled and unhealthy character of the coast region, and the high mountain barriers between it and the settled parts of the republic. There are only two commercial ports on this coast, neither of them important, Tumaco and Buenaventura, though there are other natural harbors which will be of service if there is ever any demand for them. This coast has no railroad connection with the interior.

ECUADOR.—The bays on this coast are commonly broad, open indentations and the rivers discharging into them are obstructed by bars. The harbor of Esmeraldas is near the mouth of the Santiago River, which is obstructed by a bar across its mouth so that ships anchor outside in an open roadstead, only slightly protected.

Guayaquil.—The gulf of Guayaquil is the largest gulf on the Pacific coast of South America. Its mouth is 140 miles wide and it penetrates into the land 100 miles, terminating in the Guayas estuary. Steamers drawing 22 feet can anchor at its landward end at the port of Guayaquil, one of the most important South American ports on the Pacific; 90% of the foreign commerce of Ecuador, amounting to approximately \$20,000,000, annually passes through this port. A railroad, 290 miles long, built a few years ago, runs between Guayaquil and the Capital, Quito, but the other means of interior communication are primitive.

PERU.—The coast line of Peru has few protected anchorages and the headlands are generally abrupt and lofty. The coast itself is nearly as destitute of vegetation as the African Sahara. There are several harbors, but with the exception of Callao, they are generally small, open roadsteads where landing is difficult.

Callao, the chief coast town of Peru and the port of Lima, almost monopolizes the foreign trade. Its harbor, one of the best on the western coast of South America, has been greatly improved by port works which were built at a cost of \$10,000,000 and which allow the largest steamships to lie alongside the quays in comparatively quiet water, protected on all sides. In 1912 the foreign commerce of Peru amounted to \$70,000,000, the largest part passing through Callao. The only communication with the interior is by a single line of railway to Lima, and by primitive roads and mule paths.

CHILE.—The coast of northern Chile is singularly deficient in good harbors. Those of the desert regions, the nitrate ports of Antofagasta and Migillones, are only slight indentations in a remarkably uniform coast line, sheltered on one side by a point of land or small island; the landings are generally dangerous because of the surf, and the anchorages are unprotected from storms. Conception at the head of Talcahuana Bay is the chief port and best harbor of Central Chile, and is the naval stronghold of the republic.

Valparaiso.—Valparaiso is situated on a broad, open bay slightly over three miles wide. Good shelter is afforded from southerly and westerly storms, but the bay is open to those from the north. Often vessels have to slip their anchor and put to sea to avoid destruction during a northerly gale. There are two lines of railways connecting it with the interior, the transcontinental line between Valparaiso and Buenos Aires and the government line to Santiago. The foreign trade of Chile in 1912 was \$250,000,000, with over half passing through Valparaiso. The southern 1000 miles of the Chilean coast contains a perfect succession of bays and inlets affording safe harbors, but the mainland and the islands are practically uninhabited and the climate is uninviting.

NORTHERN COAST OF SOUTH AMERICA

The northern or Caribbean coast of South America contains the harbors of Baranquilla, Cartagena, Maracaibo, and La Guaira.

COLOMBIA.—The Caribbean coast line of Colombia has a length of 700 miles, with bays of considerable size at Tumaco, Choco, Magdalena, Cabita, and Octavia; some of them afford exceptionally safe and well sheltered harbors. The most important harbor is Baranquilla.

Baranquilla.—The principal port of the Republic is situated on the Magdalena River, the chief means of communication with the interior. Its sea-port or landing place, is Puerto Colombia, where a steel pier 4,000 feet long has been built out to deep water, alongside which ocean-going vessels can receive and discharge cargo. The bay is slowly filling with the silt brought down by the river. The port is extremely well situated, for the one outlet of Colombia is the Magdalena River.

Cartagena.—The best port on the coast lies about sixty-five miles southwest of Baranquilla. The harbor is shut in by two long islands lying parallel to the mainland, and affords deep and secure anchorage and ample facilities.

ties for loading and unloading vessels of large size. The city itself has no modern quays and large vessels do not approach within a mile of its landing stages, but the railroad pier on the mainland opposite permits the mooring of the vessels alongside. The city is connected by a short railroad to the Magdalena River.

VENEZUELA.—The coast line is 1876 miles long and has thirty-two harbors, large and small; comparatively few of these, however, are open to foreign commerce. The large indentations are (1) the Gulf of Maracaibo, (2) the Gulf of Paria, between the peninsula of that name and the island of Trinidad, (3) the Gulf of Cora and the Gulf of Cariaco. The commerce of these ports, both foreign and domestic, is small. The foreign commerce in 1908 amounted to approximately \$24,000,000. The commerce of Venezuela is small, due to the fact that tariff schedules are exorbitant; much of the coast is fever stricken, the people impoverished, and the government wretched. Communication with the interior is difficult; the entire republic has only 540 miles of railroad. The two leading ports are La Guaira and Maracaibo.

La Guaira.—La Guaira is situated on the north central coast; it has the reputation among sailors of having the worst harbor in the world. It is merely an open roadstead beset by many dangers and difficulties. The harbor has been improved, however, by the construction of a concrete breakwater running out 2,044 feet. This port carries on about 52% of the foreign trade of the Republic.

Maracaibo.—On the west shore of Lake Maracaibo is one of the principal commercial centers and shipping ports on the northern coast. The bar at the entrance to the channel does not admit vessels drawing more than 12 feet, but there is a depth of 30 feet inside and near the city. The interior communications, both by river and railway, are fair, the rivers being navigable for short distances into the coffee regions.

THE GUIANAS.—The three Guianas, British, French, and Dutch, have a poor coast line; the leading harbors have bars at their mouths which prevent the largest vessels from entering. Communication into the interior is fair, for the two most important rivers are navigable for a distance of 50 miles into the interior. The most important ports are Cayenne, where the harbor is so shallow at its entrance that craft drawing more than 14 feet of water are obliged to anchor six miles from the town; Georgetown, British Guiana, and Paramaribo, Dutch Guiana.

THE ATLANTIC COAST

The eastern coast of South America is favored, for the most important and best of her harbors are situated on the greatest highway of commerce, the Atlantic Ocean.

BRAZIL.—The coast of Brazil is indented with a number of almost land locked bays, spacious and accessible. The most important are Santos and Rio de Janeiro. Communication with the interior by the rivers of the plateau is

restricted, but the Amazon furnishes excellent navigation into the interior. The only ports having a rich and populous country behind them are Rio de Janeiro, Santos, and Bahia and these are the termini of important lines of railway into the interior.

Rio de Janeiro.—The harbor of Rio is the largest and most important in Brazil and one of the finest in the world. The entrance is open to vessels of the largest size. The bay is 100 miles in circumference and almost everywhere 60 feet deep. The commercial quays are built in deep water and permit the mooring alongside of the largest vessels. The total length of the quay is about 3800 yards. The new port works, under construction since 1903, consist of a very expensive and ornamental water-front and a continuation of the sea wall southward. Rio is the seaport for a large area of the richest, most important, and most thickly settled part of Brazil. Its exports amount to 2/5 of the entire exports of the country, and its imports are relatively as large. It is well connected with the interior by important lines of railway and has also regular steamship communication with the principal ports of Europe and America.

Bahia is situated on the bay of All Saints, a horseshoe shaped bay, ten miles wide at the entrance, twenty-seven miles long, and in the center about twenty miles wide. The harbor is sheltered; steamers cannot approach the dock, but lie at anchor in the bay about a mile from shore in still water. Railways give it excellent connection with the interior.

Recife or Pernambuco is one of the important ports of Brazil, on account of its proximity to Europe. Its harbor consists of an outer and inner anchorage, the former an open roadstead separated from the latter by a remarkable stone reef. The harbor has been improved at a cost of \$8,000,000. Steamers, unless they draw less than 23 feet of water, do not go within the reef, but lie at anchor about a mile outside. The general level of the city and neighboring coast is too low to be healthy and it has a high death rate. The railway communications with the interior are good.

Para, the entrepot for the Amazon valley and the principal commercial city of northern Brazil, lies at the junction of the Guama and Para rivers, about 86 miles from the Atlantic Ocean. The Para is about 20 miles wide here. The harbor is accessible to large steamers, but those of light draft only can lie alongside the quay, the larger vessels being compelled to anchor some distance out. Communication with the interior by large vessels is possible by the Amazon.

ARGENTINE REPUBLIC.—Although having a great extent of coast line, Argentina has few good harbors. The two most frequented by ocean going vessels are Buenos Aires and Ensenada (LaPlata) both of which have been improved at great expense. The best natural harbor is that of Bahia Blanca, about 530 miles by sea south of Buenos Aires. About 100 miles south of Bahia Blanca is the sheltered port of San Blas and between the 42nd and 43rd parallels are the land-locked bays of San Jose and Nueva, the first as yet un-

used. North of Buenos Aires on the Parana River is the port of Rosario, the outlet of a rich agricultural district, ranking next to the federal capital in importance. The principal centers of the railway system, approximating 13,000 miles, are Buenos Aires and Bahia Blanca, while the La Plata river-system furnishes excellent means of interior communication. The foreign trade in 1913 amounted to \$900,000,000.

Buenos Aires.—Buenos Aires is situated on the west shore of the La Plata estuary, about 55 miles above its mouth. The estuary at this point is 34 miles wide and so shallow that vessels can enter the docks only through artificial channels kept open by constant dredging. Previous to the construction of the new harbor, ocean going vessels of over 15 feet draught were compelled to anchor in the outer roads, some 12 miles from the city. The communication with the shore was effected by means of steam tenders and small boats. The harbor has been improved by dredging and deepening the channel, erecting docks, and quays, installing warehouses, hydraulic cranes, and twenty-eight miles of railway-siding at a total cost of \$40,000,000 up to 1908. The city is the principal terminus and port for nearly all the trunk lines of the republic.

Bahia Blanca is situated on the Naposta River, three miles from its outlet into a deep, well sheltered bay of the same name, about 447 miles by rail southwest of Buenos Aires. It is the natural shipping port of a rich district from which great quantities of wheat and wool are exported. The harbor has long been recognized as one of the best on the Argentine coast, and when the channel is properly dredged, it will admit steamers of 30 feet draught at low water. Five or six important lines of railroads connect it with its rich hinterland.

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PRECIOUS METALS IN ALASKA

The annual statement on gold, silver, and copper in Alaska for 1914 has just been issued by the United States Geological Survey. The value of the total output of these three precious metals for the year aggregated \$18,835,520.

GLACIERS AND GLACIATION OF SOUTH AMERICA*

By Walter H. Schoewe
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THE SNOW LINE

THE snow line of South America varies from north to south according to latitude and elevation and from east to west according to the wind belts. From northern Colombia at an elevation of 16,000 ft. the snow line gradually descends to 15,000 ft. at the equator from which place it rapidly ascends to 17,500 ft. in northern Peru and 20,000 ft. in the sub-tropical high pressure regions situated between latitude 17° and 27° S. From this highest snow line limit, the snow line gradually sinks to 1700 ft. at the extreme southern tip of the continent. The eastern mountains carry the lower snow line in the region north of the equator and in the sub-tropical pressure belts, due to the abundant precipitation from the Trade Winds, while south of the high pressure belt, the Prevailing Westerlies supply the coast mountains with the most moisture.

THE PRESENT DAY GLACIERS

The Tropical Glaciers.—The glaciers of South America can conveniently be grouped into three divisions. The first division, the tropical glaciers, which include all ice streams lying north of Chili in consequence of their position in high latitudes are, as one might readily expect, small and end at high elevations. Furthermore they all seem to be receding, as their numerous moraines now testify. True valley glaciers of the alpine type do not exist in the tropical region of South America. Instead, only small hanging and cirque glaciers are found. In central Peru, the ice streams now end at 16,000 ft.; at 16,000 ft. in eastern Bolivia between 16° and 21° S. latitude; and at 15,000 ft. and 15,000 ft. in the eastern and western Cordillera of Ecuador respectively. In Colombia, the ice tongues reach down as far as 16,000 ft.

Characteristic of the tropical glaciers is the fact that the amount of water yielded to the streams by the melting ice tongues is extremely small. This condition as well as the curiously dry, stony appearance of the ice, which looks more like granite than compacted snow, is explained by the relative rapidity of evaporation which takes place over the high tropical glaciers. The extensive formation of large sized *nieve penitente* and ice cascading avalanches are also very characteristic of these glaciers. The noise of running water, the slipping of stones, the cracking in the substance of the glacier, all so characteristic of the glaciers of the Alps, are practically unknown in the regions of the tropical glaciers.

In the caldera of some of the extinct volcanoes, large ice masses collect. Thus, in the crater of Cerro Altar, $1^{\circ}54'$ S. latitude is found an ice field

*Summary of a paper presented in the Geographical Seminary at the University of Wisconsin and submitted to the criticism of Prof. Lawrence Martin.

3,300 ft. wide. The sea of ice finally escapes through an opening in the crater rim. The glacial tongue descends a valley for a distance of $1\frac{1}{2}$ miles where it is discharged as ice avalanches over precipitous rocky walls into a gully below. This $1\frac{1}{2}$ mile-long glacier is the nearest approach to a true alpine glacier.

The Temperate Glaciers.—These include all the glaciers in Chili and Argentina as far south as 46° S. latitude. Not only have they greater length and a more truly alpine character, but they naturally terminate at lower elevations. Lying in the central Cordillera between Aconcagua and Tupungato in latitude 32° — 33° S. are approximately 25 glaciers. Many of these descend as far down as 12,000 ft., while the lowest elevation reached in this district is by the Juncal II. glacier which terminates at 9300 ft. In size the glaciers of this zone vary from small ice streams $\frac{1}{2}$ mile or 1 mile in length to glaciers having a length greater than 5 mi.

The Great Glaciers of Patagonia.—Of an entirely different magnitude is the glaciation of the southern part of Chili and Argentina. The great area of snow fields and valley glaciers which extends north to about 46° S. latitude sends out to the east and west great ice streams which reach lower and lower altitudes to the southward. At least 55 glaciers or ice tongues are known to fringe the great snow-fields of the Patagonian Andes. This third glacial division is divided into a northern and a southern section, the former extending north from $47^{\circ}45'$ S. latitude, where Baker fiord cuts across a large proportion of the width of the Cordillera, to latitude 46° S., while the latter section stretches south about 4° from the Baker fiord. In the northern section most of the glaciers end before reaching the sea. Unlike the glaciers of the northern section, practically all of the ice streams of the southern section on the western side descend to the sea where they discharge icebergs into the waters of the numerous fiords. None of the valleys are ever free from ice. In the eastern part of this southern glacial zone almost all of the ice tongues empty into glacial lakes formed by former great ice masses. The fiorded coast and the numerous large lakes are particularly characteristic of Patagonia. All of the glaciers of this region with the exception of three have been rapidly retreating when seen in recent years.

Still farther south in the great Patagonian ice zone lies the region of Tierra del Fuego with its numerous glaciated straits and fiords. One of its many glaciers, the Hassler, has been described as one mile wide and at least three miles long, in 1872, entirely free from any kind of debris, and as smooth and shining as a mirror. Notches or caves 30 to 40 feet in height and 100 feet in depth were numerous in the steep ice front. Lying in front of the glacier were numerous lakes and a series of moraines marking three different pauses.

PAST GLACIATION OF SOUTH AMERICA

The present day glaciers of South America are only the remnants of a one-time more extensive glacial system. At present all of the known glaciers

of South America, with the exception of three of the Patagonian ice streams, are rapidly retreating. One of these advancing ice streams is the Bismark glacier in latitude $50^{\circ}30'S$, longitude $73^{\circ}W$. Since 1899 this *mer de glace* has been moving forward, while its neighbors on each side have been retreating. Between 1880 and 1899, the Bismark glacier retreated from a place in the lake into which it is again advancing. At present the glacier terminates in Lake Argentino at an elevation of 7800 ft. The glaciers of South America have within the last few decades retreated from 170 ft. to 700 ft. as their recessional moraines now testify. Sometimes between the glacier snout and the outermost moraine, a series of recessional moraines appears, occasionally as many as eight in number, indicating that the retreat of the glacier was not continuous. Such a series of seven of young moraines is found lying in front of the Hassler glacier in Tierra del Fuego.

THE FORMER ICE PERIODS

Evidence of former glaciation is met within all of the Cordillera where glaciation is present now. Lateral moraines, some of which can be traced up on both sides of the valleys for over $3\frac{1}{2}$ mi., numerous terminal and recessional moraines, abundant glacial lakes—some filled, others containing water—cirques, typical U-shaped valleys, *roche moutonnees*, etc., all give testimony of a once greater glaciation in the Cordillera. The many glacial lakes found in Peru and Ecuador generally lie between 13,000 and 15,800 ft. which height also practically coincides with the numerous glacial terraces found in the same countries. For the average elevation of the lower limit of moraines in Peru and Ecuador, Sievers gives the figure of 13,000 ft. This same observer also found that the moraines of the western Cordillera descended to lower elevations than those in the eastern mountains. Not only did the moraines descend lower in the western Cordillera, but also the typical U-shaped valleys occupied lower positions, were more numerous, and better developed than those to the east, thus showing that the western Cordillera received the larger glaciation.

From the observations and reports of the Chili-Argentina Boundary Commission (1896-1902) it is now known that at the time of maximum glaciation, the Patagonian glaciers extended eastward to the Atlantic ocean at $49^{\circ}S$. latitude whence the edge of the ice took a northwesterly direction to longitude $70^{\circ}W$. and then maintained a northerly course practically coinciding with that meridian. Hauthal's conclusion regarding the glaciers of Patagonia today is that the character of the former ice tongues was identical with that of today, except that the earlier ice field was of much vaster extent.

According to Meyer and Hauthal there are at least two, probably three, separate glacial periods represented in South America. Of these, the first one was the greater of the two. In Peru and Bolivia, Hauthal believes he found evidence of the first period of glaciation as low as 12,000 ft. and 10,000 ft.; according to this, the snow line must have been between 13,000 ft. to 15,000 ft. altitude. The same observer was able somewhat more ac-

curately to fix the snow line of the second glacial period between 16,000 ft. to 17,000 ft. and the glacier limit around 14,000 ft., while Sievers places the glacier limit at 13,000 ft. According to Meyer's observations the glaciers in Ecuador ended during the second glacial epoch between 12,000 ft. and 13,000 ft. In round numbers the lower glacial limit of the former ice periods in the tropical glacial zone lay from 3,000 ft. to 4,000 ft. lower than at present.

According to Hauthal and others, mountain glaciation of the earlier periods was not greatly different than that of today. In the ice periods the same climatic harmony predominated as does today, only several octaves lower. Exactly as today, the earlier glaciers received their local coloration, their local toning off through the local climatic relationships, that is, where now the snow line lies high as a result of a dry climate, there also the snow line had a high position during the former ice periods and vice versa. The general climate of South America during the earlier ice periods, on the other hand, differed from the general climate of the country today in being colder and having a greater amount of precipitation.

Not only was a larger area in and near the mountains of South America glaciated during Quaternary time, but evidence in the form of tillite also points to a Permo-Carboniferous glaciation. South of the equator a zone of this Paleozoic glaciation has been found; its limits have not been determined, but it is known to have extended between 21° to 35°S. latitude.

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OUTLINE FOR THE STUDY OF FROST AND PROTECTION AGAINST FROST DAMAGE

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NOTE: Frost damage is due to the low temperature and not to the formation of frost; "black frost" or "dry freeze" is as dangerous as hoar frost. The actual damage depends upon the degree and duration of the cold, and upon the condition of the plant at the time. Aside from the "general freezes," when large masses of air are involved, freezing temperatures are reached only on clear quiet nights. The drainage of the cold air to lower levels results in heavier frosts in the valley bottoms and similar places. Frost must be regarded as a local phenomenon, although the general conditions must be favorable for freezing temperatures. Of course, the whole of a very wide area may have frost at the same time.

Protection against frost damage depends upon

- I. Prevention of freezing temperatures by adding heat to the air
 1. Fires
 2. Steam pipes
 3. Hot water in ditches
 4. Electric heat (not yet practised).
- II. Prevention of freezing temperatures by checking terrestrial radiation
 1. Covers of lath, cloth, paper, or glass
 2. Clouds of smoke, steam, or fine mist

3. Increased humidity from
 - a) Evaporation of water by heat
 - b) Irrigation with hot or cold water
 - c) Sprays of water or steam.
 - III. Prevention of freezing temperatures by increasing the specific heat of the surface of the earth
 1. Flooding
 2. Irrigation.
 - IV. Prevention of freezing temperatures by mixing the air
 1. Wind breaks
 2. Mechanical movement (not yet practiced).
 - V. Protection of frosted plants from too rapid warming by the sun
 1. Shading
 - a) Covers or roofs of lath, cloth, or paper
 - b) Clouds of smoke or steam
 2. Spraying with cold water just before sunrise.
- Effective frost fighting depends upon
- I. Knowledge of
 1. Nature of frost and frost damage
 2. Times and places of frost occurrence
 3. Methods of protection.
 - II. Preparation by
 1. Receipt of frost forecasts
 2. Having materials for fighting in readiness before the beginning of the season of possible frost
 3. Detailed plan of action.
 - III. Co-operation
 1. With the U. S. Weather Bureau and other organizations
 2. Among the growers of the region.

THE USE OF U. S. GEOLOGICAL SURVEY MAPS

The intrinsic worth of the Geological Survey's topographic atlas sheets as a means of education for school children is but little appreciated. Engineers have long realized the excellence of the Survey maps, automobilists and hikers have become educated to them, but the stimulus they afford to school children not only in the study of geography but of history and American literature is yet to be recognized.

A careful study of the Survey's atlas sheet of Boston and vicinity, for example, will convince the progressive teacher of the unlimited possibilities in this map. The map of Boston and vicinity is double the size of the standard sheets and sells for 20 cents a copy. Orders should be addressed to the Director, U. S. Geological Survey, Washington, D. C., and accompanied by remittance.

CHILE

CHILE is a land of possibilities. Her principle geographical disadvantages lie in her shape and situation. The former is unfavorable to unified development, due to the separation of the country 3000 miles long into such unlike regions. It is a difficult matter to keep them united in sentiment and interests. To a certain extent, however, the past isolation of Chile is being overcome; the trans-Andean railroad from Valparaiso to Buenos Aires gives connection with the foremost South American seaport, one which has direct communication with Europe. It is possible to make the trip, a distance of eight hundred eighty miles, in forty-eight hours, with an all-night stop at Los Andes. The Panama Canal is another offset to the disadvantage of situation.

COMPARISON WITH JAPAN

Japan and Chile are somewhat similar in situation and shape. Both are long, narrow, and mountainous; both are far away from leading commercial countries. Japan, by actual measurement, is farther away from United States and European countries than is Chile, yet Japan is recognized as one of the leading nations. Japan is only one-half as large, yet it supports about seventeen times as many people. The area of arable land in Chile is greater. It is probable that Chile, with intensive farming, could support more people than Japan. But there is a difference in the people. The Chileans have much Indian blood in their veins and that may account for their failure really to make conspicuous progress as a nation.

CONDITION OF THE PEOPLE

The system of great landed estates in Chile is a serious drawback. The poorer class have little chance to own land as long as the present system exists. The strength of a nation is measured in terms of a strong, land-owning middle class. It seems necessary for Chile to provide that the middle class may more generally own property, especially farm land. The system of suffrage is a weakness since only twenty-five per cent vote. Those who are not encouraged to vote take little interest in governmental affairs.

The Chileans recognize the need of trained men and women and have provided schools. But public sentiment is not in favor of all classes attending school, so no compulsory law is in force.

NITRATE FIELDS

The rich nitrate deposits are the cause of lavish expenditures. In 20 years Chile has received \$425,000,000 from export duties on nitrate. This is not used to rid a poor country of its national debt but for building showy structures in their principal cities. There is a possibility of exhausting the supply of nitrate. When such a time comes the Chileans will be wholly unprepared, for they have no system of land tax. Should such a tax be gradually

imposed, while some of the revenue money is conserved, it would save Chile a great calamity.

ADVANTAGES OF CHILE

Chile's advantages are greater than her disadvantages. Soil, much of which is naturally fertile; minerals—nitrate, coal, iron, and copper; dense forests in the south, and abundant water power, make her rich in natural resources. With these advantages there is no natural obstacle to Chile's becoming a manufacturing country. The fact that Chile contains most of the coal in South America ought to lead to a greater development of this resource.

Chile ranks third among the countries of South America. The people call themselves the Yankees of South America. Chile is younger than the United States, but has the advantage of being young in this age of the world.

Granted a change in land ownership and forty years more of development we may witness a marvelous change.

Emily A. Budd.

THE GEOGRAPHY TEACHER'S RESOLUTIONS

AT the opening of the new school year, I hereby record my resolution,—
1. To attempt to teach a smaller number of facts than I did last year, to select those facts more thoughtfully, and to impress them more lastingly.

2. To make constant use of the wall map.

3. To make the study of the map and of the map questions in the book a liberal portion of each week's work.

4. To have my pupils make free-hand sketch maps, rapidly drawn, as a means of impressing mental map pictures.

5. To try to impress a limited number of significant facts about each country, so that my pupils shall appreciate what each country really represents in the family of nations,—come to feel that each country has its own individuality, stands for certain ideals and contributes certain things to the world's progress.

6. To have my pupils clip geographical items of importance from the papers or magazines and tell why the items are important.

7. To cultivate in my pupils the habit of using the atlas, the encyclopedia, the annual statistical abstract of the United States, the Census reports, and other standard reference books.

8. To use the illustrations which my own city and region supply, as a means of understanding the geography of more distant places.

9. To prepare my own lessons so that I can teach interestingly and confidently.

10. To try to remember that geography is inherently interesting to children, and that they will like it if it is well taught.

R. H. W.

THE DISCOVERY OF THE PAINTED STONE, AN EARLY OBSERVATION OF THE DRIFTLESS AREA

IN southwestern Wisconsin, as is well known, and to a small extent in southeastern Minnesota, northeastern Iowa, and northwestern Illinois, there is a Driftless Area,—that is, a region which has never been covered by ice, although the land on all sides of it was once buried by glaciers similar to those found today in Antarctica and Greenland. The region covers nearly 15,000 square miles. Its dimensions are roughly 210 miles north and south by 120 miles east and west. The observations referred to below were published in W. H. Keating's "Narrative of an Expedition to the Source of St. Peter's River, Lake Winnipeek, Lake of the Woods, etc. etc." performed in the year 1823, Vol. 1, Philadelphia, 1824, pp. 200, 263, 287-288.

Nearly a century ago Professor Keating, a geologist from the University of Pennsylvania, travelled overland from Chicago to Prairie du Chien, and then went up the Mississippi to Minneapolis. In southwestern Wisconsin he noted the absence of the granite boulders, elsewhere known to have been brought by the continental glacier, but which he thought of as erratics of very old, or "primitive," rock, transported during the Flood. He commented upon this change and he did so close to the southern border of the district we now call the Driftless Area. After crossing the Driftless Area he also observed the resumption of the erratics at the first point where one could possibly see them while following Keating's route. This was close to the northwestern boundary of Wisconsin, at Red Rock, below St. Paul, Minnesota. Just after he passed Lake St. Croix, Keating says that they:

"landed, for a few minutes, to examine a stone which is held in high veneration by the Indians; on account of the red pigment with which it is bedawbed, it is generally called the painted stone. They remarked that this was the first boulder of primitive rock, which they had seen to the west of Rock river. * * * It is a fragment of sienite, which is about four and a half feet in diameter. It is not surprising that the Indians should have viewed this rock with some curiosity, and deemed it wonderful, considering that its characters differ so materially from those of the rocks which are found in the neighbourhood. A man who lives in a country where the highest hills are wholly formed of sandstone and secondary limestone, will necessarily be struck with the peculiar characters of the first specimen of granite that comes under his notice, and it is not to be wondered at, that one who 'sees God in all things,' should have made of such a stone an object of worship. The Indians frequently offer presents to the Great Spirit near this stone; among the offerings of their superstition, the party found the feather of an eagle, two roots of the "Pomme de Prairie," (*psoralea esculenta*, Nuttall), painted with vermilion; a willow branch whose stem was painted red, had been stuck into the ground on one side, etc. The gentlemen broke off a fragment of this idol, to add to the mineralogical collections, taking care, however, not to leave any

chips, the sight of which would wound the feelings of the devotee, by convincing him that the object of his worship had been violated."



Map showing Driftless Area.

Thus we see that Keating, who was almost the first geologist to visit the Driftless Area, clearly recognized its phenomena at both borders. His only geological predecessor, Schoolcraft, also identified its boundary, but at a later time and in another place, for Schoolcraft mentions nothing of this sort in his first journey, three years before Keating's. Major Pike likewise landed at the Painted Stone in 1805, but he did not know its significance. Major Long made observations in 1817 that would have enabled him to recognize the Driftless Area phenomena if he had been a geologist. Other early observations of the Driftless Area phenomena were made independently in Colhoun in 1823, Schoolcraft in 1831, Owen in 1839, Hodge in 1841, Lapham in 1844, Norwood in 1847, Daniels in 1854, Percival in 1855, Whitney in 1862, Strong in 1874, McGee in 1878 and many others. It was correctly explained by Irving, Winchell, and Chamberlin in 1877 and 1878. The most complete description of the Driftless Area was published by Chamberlin and Salisbury in 1885.

In 1823 Professor Keating even collected a specimen from the Painted Stone—the first erratic he saw after leaving the Driftless Area. But he was not the real pioneer, for the naked aborigines had painted the stone red, and worshipped it!

LAWRENCE MARTIN.

CURRENT GEOGRAPHICAL NOTES

GEOGRAPHY WITH THE ALLIES IN THE PRESENT WAR?

Count Reventlow points out that the alliance against Germany now comprises Russia, England, France, Belgium, Servia, Italy, Japan, and Geography; and that only to the last named ally can be attributed such successes as have been scored against Germany on the sea:

How must it be with British reliance (says Count Reventlow) when the First Lord of the Admiralty boasts of having driven German trade off the seas? That is less due to the accomplishments of the British fleets than to the geographical configuration of the North Sea. The British Isles dominate the exits, making barriers for trade remarkably easy.

It is plain that if the North Sea were as big as the Pacific, or Germany were situated off the coast of Tasmania, things would be different. For the nation of *Realpolitik*, for a people that scorns sentimentalities when it comes to the business of war, and insists on hard facts, it is rather odd to complain against the North Sea being where it is. It is the German way of using science to make a special case. We have been told that the war was a biological necessity for Germany, because she has seventy million people, and a geographical necessity because Germany lies where it does. The invasion of Belgium was also justified by geography. Germany's ultimate triumph is a physiological necessity, because of her superior nervous organization, and a psychological necessity because of the will to conquer. But England must be denied the consolations of science. However, the laws of logic must not be too strictly enforced amidst the clash of arms. So *Gott strafe* the Glacial Period, or whatever it was that made the North Sea.—[*The Nation*, Aug. 12, 1915.]

MAP OF THE UNITED STATES FOR 1 CENT

Teachers who are not familiar with the many and various maps published by the United States Geological Survey will be interested to learn of a small map of the United States which is sold by that bureau at the nominal price of 1 cent. This map shows rivers, lakes, State boundaries, State capitals, and principal cities, but not the less important features, whose numerous names and symbols tend to create obscurity and confusion. It measures about 8½ by 12 inches.

The Survey publishes also maps of the United States on larger scales, one on a scale of about 190 miles to 1 inch, for 5 cents retail, and one on a scale of about 110 miles to 1 inch, with contours to show relief, or without contours, for 15 cents retail.

A relief map of the United States measuring 18 by 28 inches, on a scale of 110 miles to the inch, is sold for 15 cents. This map shows the rivers, principal cities, and State boundaries, and is shaded in colors to show the heights above sea level of all parts of the country.

Address the Director, U. S. Geological Survey, Washington, D. C., and accompanied by remittance, in cash or postal money order.

THE INEFFECTIVE BLOCKADE OF THE BRITISH ISLES

It is now almost exactly six months since the German Admiralty proclaimed its submarine "blockade" of Great Britain, and announced that "every hostile merchantman . . . will be destroyed." What are the net results of military value? One great aim of the campaign was to cut off supplies from England—especially foodstuffs. Without imported food, England would starve. Thus the English threat of starving out Germany was to be re-torted. Yet during the first five months of submarine activity in British waters, the official figures of imports show that 100,000 tons *more* of foodstuffs were received in England than during the corresponding five months of 1914. This does not look as if the German plan of reducing England by starvation were succeeding any better than the British scheme to leave Germany with only half enough food to live on. As for the actual destruction of British shipping—virtually all of it insured, by the way, so that the owners lose nothing—it is variously estimated, but is surely less than one per cent. of the vessels actually coming and going through the war zone. Lloyd's Register has recently issued the quarterly returns of new ships—leaving out men-of-war—under construction in British yards at the end of June. The total of 1,500,000 tons. The tonnage of the ships sunk by the Germans is a little over 200,000. Thus the British mercantile marine is not exactly disappearing. In fact, despite the submarines, the year has been one of large profits for shipowners.—[*The Nation*, Aug. 12, 1915.]

A TRAVELER'S GUIDE TO THE PACIFIC COAST

Immediately after the publication of its Northern Pacific Guidebook (Bulletin 611) the United States Geological Survey announced the issue of a guidebook covering the Shasta Route and Coast Line, embracing the territory from Seattle to Los Angeles. Its title is "Guidebook of the Western United States, Part D, The Shasta Route and Coast Line" (Bulletin 614), and it comprises 142 pages, 19 topographic maps, 33 reproduced photographs, and 15 text figures. This book is written in the same popular vein as the other Survey guidebooks, and as the country which it covers presents many notable scenic and geologic features and is pregnant with interesting history and tradition, the volume promises to be one of the most successful of the series. Turning the pages of this book, through which are liberally interspersed topographic maps and illustrations, the traveler finds interpreted for him in simple language, many things of interest.

To travel through our great West in company with a geologist gifted with the power of expression and explanation is a rare privilege. The pages of the Geological Survey's guidebooks offer an even more unusual privilege, for the information they contain is the product of many minds and comprises a vast amount of geologic, botanical, and general information, given in a simple and interesting way. The guidebook maps show the topographic features along the route.

The book is for sale by the Superintendent of Documents, Washington, D. C., at \$1 a copy.

PANAMA SHIPS AND CARGOES

A year of the Panama Canal has now passed into history. The Canal was opened to commerce on August 15, 1914, when the stalwart *Ancon*, a Panama Railroad liner, that as a transport from New York had borne a notable part in the construction of the waterway, went through from Cristobal to Balboa. There followed the next day the great *Arizonan* of the American-Hawaiian Steamship Company, and the first foreign craft on a foreign voyage came on August 22, the *Daldorch*, of Glasgow, with wheat from Puget Sound for Ireland. Sudden war had broken out; ships of belligerent flags were flying for shelter, and the best of them were being commandeered by their governments.

Twelve of the fourteen vessels that traversed the Canal during the first week were Americans. In the Review of Reviews for May, 1913, beginning an article on "American Ships at Panama," the present writer had asked: "Is the American flag to be a stranger in the Panama Canal when it is completed? Will all maritime nations be prepared and ready then to make use of the Canal except the nation whose money and energy have built it?" The year since August, 1914, has brought its clear and gratifying answer. The Stars and Stripes have led all other national colors; the merchant fleet that has made best use of the new waterway is the fleet of the United States.

All told, the net canal tonnage, on which tolls are based, of vessels traversing the Panama Canal for the twelve months ending July 31, 1915, was 4,404,364, of which by far the greatest single element was the wholly American coast-to-coast tonnage of 1,416,294. In addition to this coast fleet other American cargo vessels made a certain number of foreign voyages, particularly in the trade to and from the west coast of South America, where they were employed because of war-effects upon European tonnage. Throughout the Government fiscal year ending June 30, 1915, the tolls paid at Panama by the ships of all nationalities in all trades amounted to \$4,343,383, while the actual cost of operation for the same period was \$4,112,550. Thus, superficially, the Canal was self-sustaining, but it must be remembered that in this statement no allowance is made for interest on the capital invested, depreciation, etc. For the time being, and until normal conditions are established, the Canal must be regarded as a great, permanent public work, the value of which cannot be measured by the commercial standard of dividends.

Ships from Australasia, the nearer edge of the Far East, and the west coast of South America for Europe and the Atlantic Coast of the United States, and ships outward bound from Europe and the Atlantic Coast on the reverse routes have constituted the chief foreign tonnage passing through the Canal. These have been "tramp" vessels or the pioneers of small freight lines as a rule; few passenger and mail liners were among them.

Crude materials and foodstuffs have made up a large part of the cargoes eastbound and westbound,—sugar, coal, copper, flour, iron-ore, lumber, oil, nitrates, wines, and grain. But manufactures of iron and steel machinery

and railroad materials conspicuously figured in both coastwise and overseas commerce. As to "general cargo," including much highly finished and valuable merchandise, it is significant that out of 100,027 tons carried through the canal from the Atlantic to the Pacific, in June last, 42,929 tons were in the American coastwise trade, and out of 38,614 tons from the Pacific to the Atlantic 33,576 tons were in the coastwise trade, whose ships made up more than one-third of the entire traffic of the new waterway.

PANAMA OF CHIEF ADVANTAGE TO AMERICA

The American flag in the coast-to-coast trade will continue to float securely and proudly at Panama so long as the historic coastwise law remains unchanged. A year ago, in August, 1914, an effort to uproot it was overwhelmingly defeated in Washington. Those in this country and abroad who urged the repeal insisted that when the Canal was opened not enough American ships would be forthcoming, even for the coastwise commerce, and that foreign ships would have to be employed. That this was an error is now demonstrated by experience. American ships in coast-to-coast trade have proved to be numerous and adequate. Freight rates from coast to coast have been substantially reduced; a great new commerce is developing.

Throughout this abnormal year of war, American shipowners of the Atlantic-Pacific fleet could have enriched themselves by abandoning their proper services and chartering all their ships at unexampled rates to carry food-stuffs and munitions to Europe. But they have not done this; they have occasionally employed thus only a few spare vessels; every one of the chief services has been steadily maintained. These shipowners have honorably recognized that their first duty was to their own flag and to their own countrymen.—From "The First Year at Panama," by Winthrop L. Marvin, in the *American Review of Reviews* for September.

WHEN THE GULF OF MEXICO REACHED CAIRO

In the course of its investigations of the geology of the country, the United States Geological Survey has found that the ocean formerly covered much of what is now the Atlantic Coastal Plain, while the Gulf of Mexico spread widely over the central Southern States, probably reaching as far north as Cairo, Ill. The Ohio was then a longer and older river than the Mississippi. Some of the sediments of this age, now hardened into rocks, were deposited in a shallow sea, some about the mouths of rivers, and some perhaps in the flood plains of the rivers themselves. All these different types of sediments, as found in the eastern Gulf region, are described in the United States Geological Survey's Professional Paper 81, which may be obtained without cost by applying to the Director of the United States Geological Survey, Washington, D. C.

NEWS NOTES

Dr. Lucy Wilson, head of the Department of Geography of the Girls' Normal School, Philadelphia, was engaged during the past summer in excavation work in New Mexico. As the result of her work she has brought back to the Philadelphia Museum nearly a half-ton of pottery, primitive stone objects, skeletons, etc. Dr. Wilson, with the aid of Indians, excavated 36 rooms in the ruins of Otowi in the Jemez National Forest, New Mexico, and unearthed a great quantity of interesting material.

Prof. O. D. von Engel of Cornell University, has contributed an excellent article on the "Geography of the Ithaca (N. Y.) Region," to the Centennial number of the Ithaca Journal, recently issued. The article covers two and a half newspaper pages and is illustrated with a map and two block diagrams.

A. J. Nystrom & Co., Geographical publishers, Chicago, have just issued catalog No. 16, nearly 200 pages. It includes models, globes, black-board outline maps, political maps, commercial maps, physical maps, historical maps, charts, atlases, geographical pictures and much other material. Geography teachers should have a copy on file.

Prof. Jas. F. Chamberlain of the Los Angeles Normal School, represented the National Council of Geography Teachers at the Oakland meeting of the National Education Association. He has sent in the following report of the meeting:

GEOGRAPHY AT THE OAKLAND MEETING OF THE N. E. A.

During the recent sessions of the National Education Association, held in Oakland, California, there occurred an interesting and profitable conference of teachers of geography, principals and superintendents. In a general way the conference represented the National Council of Geography Teachers, although the national officers assumed no responsibility for the meetings. There was a forenoon and an afternoon session, and both were well attended.

"Geography in Colleges and Universities" was presented by R. S. Holway of the University of California and W. H. Snyder, principal of the Hollywood high school, Los Angeles; Mrs. Mary W. George of the San Jose State Normal School and James F. Chamberlain of the Los Angeles State Normal School, dealt with "Geography in Normal Schools." The forenoon session was devoted to these topics. In the afternoon "Geography in High Schools" was discussed by Roy E. Dickerson of the Mission High School, San Francisco, and George C. Bush, principal of the South Pasadena High School. The last topic to be presented, "Geography in Elementary Schools," was handled by Harold W. Fairbanks of Berkeley, California, and Mrs. M. Alice Hanson, of Pasadena, California.

There was an animated and profitable general discussion which was participated in by a large number of persons. Much interest was shown in the Council of Geography Teachers, and many teachers joined the organization.

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IDEALS AND AIMS IN ELEMENTARY GEOGRAPHY

By the Editor

WHY is geography made one of the four or five fundamental studies in the schools of every enlightened country? If we were to go into any one of the thousands of elementary schools in the United States, we should find that geography is taught there. If we were to go into the schools of Canada, Europe, Australia, Japan, India, Argentina, Chile, Brazil, New Zealand, we should find geography classes in all of them. This is true whether the schools have inherited their ideals and practices from England or France, Spain or Italy, Russia or Portugal. Only a knowledge of reading, writing, and numbers is considered more basic. Occasionally a man is found who does not favor placing any stress on school geography, but such a man is so very rare that his views need receive no attention. The fact is: *I. The study of Geography in schools is nearly universal because the need of it is practically universal.*

HOW SHALL THE STUDY OF GEOGRAPHY BEGIN?

The child's geographical knowledge is a matter of growth. He is born with none and the experiences of his pre-school days furnish him very little. Nor has he any hunger for geographical knowledge, for he does not feel any need of it. No one is likely to desire a thing until he thinks he has use for it. If it were possible in our educational practice to arouse in children a desire to know—a feeling of the need of knowing—before we had to offer the knowledge to them, our task of teaching would be easier. Unfortunately we think we must put children through a forcing-house process, and that means insisting that they learn a great many things which they have no visible need of, and do not see that they ever will have. Of course there can be no pleasurable mental reaction over the acquiring of things you don't need at least not so far as you can see.¹ This is one reason why so much school work is irksome. The pupil doesn't see the use of the information you are giving him; if he could, he would not be inattentive. When he comes to you for information that he really wants, how eagerly he listens to what you have to say.

Since geography is one of the things which we know must be taught, the first step in the process ought to be a proceeding by which we shall start the little seven-year-old into a feeling of desire to know some of the things that geography will teach him. Until he has some little reason for wishing to learn, he is not in good condition to take the treatment. Our second point, then, is: *II. The beginning of geography teaching lies in making it evident that geographical knowledge will satisfy a want which the children have be-*

gun to feel. Needless to add, they will not feel this want by being told they have it, nor by explanations that later they will see the use of it.

By reason of the mere fact that they are young children and not grown-ups, they have certain interests and these are the teacher's avenues of approach. One of the child's earliest interests is in stories. The normal child loves stories, particularly stories about children and animals and strange places where people do wonderful things like driving a team of dogs, or riding camels. Now it would not be a wise use of time to hunt up these stories and spend school time in telling them solely to stir up a desire for geographical information. The stories should be worth telling for reasons quite apart from ulterior motives connected with geography. Good stories are a part of education, and they are more likely to be interesting when they deal with people and places and happenings which belong to a world beyond the child's daily life. Stories of the Eskimo, of the Indian, of children in China or Japan or Holland are the child's delight. Such stories gratify a perfectly natural interest, and their value is everywhere recognized quite apart from geography. But by selecting some stories which awaken a childish interest in the children and people of other lands, the way is made easy for the beginning of geography. Geographical information will now begin to have use in the child's world, for it gives light on things which interest him. He does not bother to reason out why he is glad to know where Russia or Scotland is; he simply is interested in that story of Boris or Donald, and he finds it satisfying to know something about the countries where they live. This, it seems to me, is the natural way for geography to begin.

WHEN SHALL GEOGRAPHY BEGIN?

Occasionally a school makes geography one of the studies of the second grade. More frequently it is put down as a third year study, but formal geography can scarcely begin earlier than grade 4. It may be introduced informally in connection with reading, stories, etc., as early as the teacher wishes. Surely in the third grade there ought to be a deliberate planning of the work so that stories of foreign people and places shall be introduced. At once the globe and map come into use—not as a formal matter, but merely incidentally, and with no elaboration. The child simply learns—if he has not already done so—that grown-up people use the map as a means of locating places or countries which they are reading about. Gradually geographical notions will be built up, ideas of the cardinal and semi-cardinal directions, of the earth's shape, of the cause of day and night, the equator and the hot belt, the poles and their cold. Most of these ideas will come out in connection with stories of the Eskimo, of the discovery of the poles, of the pigmies of Africa and the like. Definitions or formally worded statements are not yet needed.

All through the third year, the aim is to get *ideas*—perhaps they will be vague ones at first. We may be content, however, if we see the ideas growing, even though the child can not phrase them. When Asia or Europe or Japan

or Sweden are mentioned, point them out on the wall map. A large clear wall map should always hang in plain view. Gradually familiarity with the names and map pictures of the continents, the oceans, and some countries is acquired. Most children know people who came from foreign lands or who have traveled abroad. Papers and magazines have pictures of foreign places. All of these offer occasions incidentally to implant the idea that a part of one's daily life is to hear and know about people and countries across the sea; they are the teacher's opportunity to start the child out in his school life with a feeling that geography is worth while; and at this stage such a feeling is worth more than formal statements or definitions; these will come later; let ideas and interest come first.

III. Geographical ideas and an interest in geography are more important at the outset than formal statements.

WHAT ABOUT HOME GEOGRAPHY?

There is an old and respectable maxim that education should proceed from the known to the related unknown. Applied to geography this maxim gave us the so-called Home Geography. Home Geography is a good and proper thing. Assuredly, we wish the child to make use of the geographical materials around him. It has come to be a general practice to build up the idea of a map in the child's understanding by—

(1) drawing a plan of the school room, indicating in their proper places, seats, teacher's desk, book case, etc.,

(2) making a plan of the school grounds,

(3) making a map of the block in which the school is located, showing bounding streets.

There is a purpose in this: out of such exercises emerge ideas of the real purpose and meaning of a map. It is doubtful, however, whether the children of the fourth grade are ready to attempt drawing accurately to scale. They *can* do it, and if time enough is spent, they will produce a creditable map of the school room or city block. Drawing to scale is, however, the work of fairly mature minds. There is always a tendency to teach things about two years too hard for the pupils and so always to be working against difficulties of our own creation. Ideas which we can develop in the childish intellect only with painstaking effort and much drill would be grasped and digested readily a year or two later. The mind's power grows as the child grows, and we should do well if we were content to let our work progress at about the rate the mind develops instead of trying to be always a little ahead. In the long run nothing is gained. We must remember that ideas which involve much mathematical reasoning can be readily grasped at a certain stage of development, but can be grasped only with much explanation, illustration, and effort at an earlier stage of growth.

Home Geography should be taught in connection with all geography, drawing upon local illustrations whenever they will aid in getting clear ideas.

Experience seems to show, however, that a formal study of local geography continued more or less laboriously through weeks or months is a doubtful practice. On the contrary, studying things at first hand is always better than studying *about* those same things in books.

I am persuaded that early studies in geography should not aim at a high degree of exactness of knowledge or at accurate, formal statements, but rather at the development of a broad interest in peoples and countries, and a pleasure in reading and hearing about them. This is an attitude of mind. I would like to have my own children gain this attitude of mind in the first years of geographical study. Enough formal and exact knowledge will be acquired in due time; I would rather children should like geography at the end of the 5th year in school than be able to pass tests, if they can not do both; yet the two aims are by no means incompatible. That a procedure such as is suggested above may lead to desultory, aimless work is only too possible. If, however, there is a conscious aim to attain the end which is here recommended the work will not be aimless or desultory.

THE PURPOSE OF GEOGRAPHY

This all leads inevitably to the main question; that question is—*What is the geography teaching of the elementary school for?* Has it a major purpose? If so, what is it? Has it important subsidiary purposes? What are they? If we can decide what the answers to these questions are, we shall have made progress.

By reason of their inherent character, different studies lend themselves to different major purposes in the rounding out of the educated person. The study of *literature* makes for intellectual and moral refinement. That is its major purpose. The study of *mathematics* aims not at intellectual refinement but at training in accuracy, in exactness, and in close mental application and close reasoning. *American History* is a tool for developing patriotism and the qualities of citizenship.

What is geography's major purpose in the elementary school? I have thought over this question at times for many years and I always come around to the same conclusion, namely, that geography has both a utilitarian purpose and a cultural purpose, using the word "cultural" in the sense hereafter defined. Educational philosophy has passed the stage of regarding that certain branches of study are incomparably suited to giving a something called *culture*. Culture is an element of character more than an element of mind, and because this is so, the schools alone can not impart it. Contact with refined people breeds it; travel is one of the means by which it grows. Good reading, good art, good music, good drama contribute. But in the period of youth, the school is the agency particularly delegated with this culture-giving responsibility, though this is only a part of its responsibility. Broadly speaking the school aims to perform two main services:

(1) Teaching how to live. However, the immediate purpose in the lower grades is to give the child the ability to use the tools by which real education is later acquired: to learn to read, to write, to spell, and to compute.

(2) Teaching how to make a living.

A larger part—possibly a major part—of the knowledge and training which elementary geography gives, aims to fit the child to carry forward this and other school studies which follow. Yet most of this knowledge and training is of value even though the boy leaves school early in life. Either in the high school or in the workaday world he can, other things being equal, make better progress if he has a knowledge of the things which geography teaches and which no other branch is specifically responsible for teaching.

GEOGRAPHY NOT PRIMARILY A BREAD-AND-BUTTER STUDY

Let us grant that many a man is earning a living and is getting a good deal of satisfaction out of life, and doing both on a very limited knowledge of geography. Men have become millionaires and presidents who did not know whether St. Roque is a cape or a river, and the man who invented the roller process of making flour may not have known the "leading five wheat-growing states of the Union." Yet this and a great deal more may be granted without altering the general truth that geographical knowledge is a good thing and a useful thing; that it makes our reading more satisfying, our conversation more intelligent, our minds more broad, our sympathies more cosmopolitan, and our citizenship more enlightened.

GEOGRAPHICAL KNOWLEDGE GIVES BREADTH OF OUTLOOK

But our educational system is organized definitely and properly on the assumption that the school is designed as much for developing men who shall be leaders in a small way or in a large way, as it is for preparing others for merely making a living. This great, busy, national life of ours calls for leaders of tens, and leaders of hundreds as well as leaders of millions. It calls for men who have gained some of the discipline and some of the outlook which comes only by education: and geographical study is one of the branches which give outlook.

Our schools are conducted with a view to the needs of society in all of its strata, the upper as well as the lower; the lower as well as the upper, yet they must always plan with full knowledge that they are training a proportion of their pupils for positions which require breadth of outlook, and a wide range of knowledge, both of the world of the past (history) and of the world of today (geography). No man is educated who knows only his own time and his own country. If culture includes the ability to see the "now" and the "here" in their relations to the longer period of the past and the bigger world beyond our own seas, then it gains some of its substance from historical and geographical studies. To me the term culture always implies breadth—breadth of knowledge, breadth of mind, breadth of sympathy—and all of these draw some of their nourishment from geographical studies.

If taught with much field work, geography trains the powers of observation; if taught with much map drawing it trains the eye and hand; if taught

as it was in my country-school days, it trains the memory. All of these are legitimate, all deserve some degree of emphasis, yet the study of geography is not a device or an invention for accomplishing even these worthy ends of training the observation, the eye, the hand or the memory. Such training is an essential by-product of the whole educative process. Unless literature, and history and arithmetic and geography are taught primarily for their inherent value, they possibly ought to give place to studies which are worthy of pursuit for their own content.

Without intending in the least to minimize the importance of training the powers of observation or imagination or the powers of eye and hand and memory, I am still convinced that geography has its own mission in the school. That mission is to give the broadest possible knowledge of peoples and countries, their cities, their industries, their achievements, and all that goes to make them strong or weak, leaders or followers among the nations of the earth; and the principal reasons why these things are as they are. This is plainly the *anthropo-centric* idea of geography as contrasted with the *geo-centric*. It makes *man* rather than the physical earth the starting point in the study of any region or country. It means the study of both man and his geographic environment, yet it does make man the center of interest. It is geography in which the human and social aspect is more prominent than the physical aspect.

NORTHERN PACIFIC GUIDEBOOK

The U. S. Government has spent thousands of dollars in preparing a series of transcontinental guidebooks, telling the traveler of many of the wonders of the West which he sees from the car windows and concerning which he asks questions that none of his companions can fully answer. The Northern Pacific Guidebook, one of this series, has just been published by the United States Geological Survey as Bulletin 611. This volume, like the other three of the series, is to be sold by the Superintendent of Documents, Washington, D. C., at \$1 a copy. The book is in no sense a purely geologic publication, although the geology of the route is described in terms that can be readily understood by the layman. The mountains, plains, river valleys, and rocks that are seen from the car window as apparently unrelated items in the landscape are described as parts of an orderly procession, and the story of their birth and growth is so simply told as to interest the most indifferent reader.

The Northern Pacific Guidebook includes 212 pages and contains 27 reproductions of photographs, 38 text illustrations, and 27 topographic maps covering the entire route, which have been prepared with a degree of accuracy never before attempted in a guidebook.

THE WEATHER FACTOR IN THE GREAT WAR: III.

MAY TO OCTOBER, 1915*

By Robert De C. Ward
Harvard University

THE last month of spring and the three months of summer have come and gone. Yet the Great War continues. And heat and cold; rain and snow; cloud and sunshine; storm and calm—all continue to play their part, as they have been doing in all man's wars since the world's beginning. As compared with the greater turbulence and the severity of the winter, Europe's summer weather is peaceful and uneventful. Its human, its economic, its strategic relations are less striking. But to anyone—be he military expert, or meteorologist, or simply an intelligent reader of the world's news—there is vital human interest in the many varied and far-reaching controls which the ordinary day-to-day round of European weather has exerted in the progress and conduct of the Great War.

Strategic problems of great difficulty, demanding the most careful thought, and requiring immediate solution, grew out of the spectacular German "drive" into Russia, and the remarkable withdrawal of the Russian armies under the Grand Duke Nicholas. The German plan to entrap and annihilate the Russians failed.** Instead of destroying and capturing the armies of the Grand Duke, and then removing a large part of their troops elsewhere, the Germans were obliged to pursue their enemy farther and farther into his own territory; farther and farther from their own bases of supplies, and nearer and nearer to the home of the Russian winter. The desperate energy of this remarkable drive had one of its mainsprings in the necessity of reaching a military decision before the autumn rains and winter cold set in. The burned and devastated fields of Poland were bad enough while the weather was reasonably favorable. They would be a thousand times more terrible when snow-covered, and swept by icy gales and blinding snowstorms. The tremendous activity of the Germans in seeking to gain possession of the Polish and Russian railways was doubtless in large part due to their need of securing every possible line of railroad for keeping their armies supplied with provisions and ammunition when the autumn rains had made transportation across the flooded marshes and muddy roads impossible. Clearly, the situation was very serious. We may easily picture to ourselves the frequent discussions of this problem on the part of the German general officers. We may be sure that the Russian Winter loomed very large in all their plans of campaign. How far to penetrate into Russia; how much longer to carry on operations in the Polish marshes with the autumn rains not far away;

*The period from Aug. 1, 1914, to May 1, 1915, has been covered in the following articles: "The War and the Weather during the First Three Months of the Fighting," *Pop. Sci. Mo.*, Vol. 85, Dec., 1914, 604-613; "The European Winter and the War," *This Journal*, Vol. XIII, Feb., Mar., 1915, 169-171, 209-216.

**This article was completed Sept. 25, 1915.

where to dig themselves in for the winter; how to avoid even the faintest suggestion of such a disaster as that which befell Napoleon's Grand Army—these were questions whose settlement required a knowledge and a careful consideration of the weather factor. That the German commanders have this knowledge, and know how to make it of practical use in their everyday military activities, the Great War has abundantly made clear.

That the German and Austrian advance was made under many meteorological difficulties is easily seen if we read the despatches carefully. The weather of June is described as "exceptional", with "persistent" and "unseasonably heavy" rains over the greater part of Russia and Galicia. Then, and later, the flooded marshes and muddy roads made the advance of the attacking armies difficult and slow. Often the guns could be moved only when double-spanned and with the help of the gunners, who put their shoulders to the wheels. All such delays helped the Russians, by giving them time to fall back more slowly, and to make better plans for resistance on other lines. London and Paris looked forward to the coming of the "equinoctial" rains as an almost certain check to the German advance. English military experts emphatically expressed it as their opinion that these autumn rains were "the danger limit to military operations in the eastern field." Some of them recalled the fact that these same storms marked the turning point in Napoleon's campaign. The light snows of fall gave the warning. The heavy snows which came later brought the great disaster. In this year's early September rains, many of the Russian rivers overflowed their banks; roads became quagmires; marshes were flooded. A decisive battle between large bodies of troops seemed out of the question. Thus one of the German's objects in this whole eastern campaign was defeated. Last winter the Germans declared that the fall of Warsaw, which they finally accomplished, was only a question of mud!

Italy's entrance into the war, with the resulting military operations at high altitudes, brought in a new series of meteorological controls which the other theatres of war at lower levels did not offer. High mountains mean cold and snow, even in summer. They mean more clouds, and rain, and thunderstorms, than the lowlands have. They mean exposure to great extremes of heat and cold. The Russian and the Teutonic allies in the Carpathian snows; the Russians and the Turks in the mountains and highlands of Asia; the Italians and the Austrians in the Alps, have thus far had the hardest fighting against weather conditions. It is significant that the despatches from the Austro-Italian war zone, meagre as all such despatches have been, have frequently emphasized the meteorological handicaps. Over and over again, heavy rains and "fog" have checked the fighting in the mountains. Swollen rivers; flooded passes; deep mud; "bad weather" were to be expected, even in summer. The "fogs" so often mentioned were probably in most cases not valley and lowland fogs but clouds, for much of the fighting has taken place at altitudes well within the cloud zone. These "fogs" often interfered with artillery firing and with aeroplane trips, but were several times taken advantage of, by one side or the other, for making surprise attacks. "Terrific" thun-

derstorms occurred. Lightning played among the troops fighting on the rocky mountain sides. Torrential downpours swept the passes and temporarily stopped the engagements. Hail beat in the faces of the men as they charged up the steep passes and slopes. Much difficulty was experienced on account of the snow. A despatch from Brescia, June 21, notes the occurrence of a heavy snowstorm on Monte Altissimo, with temperatures "below zero" (Centigrade, doubtless), and a resulting suspension of military operations. The despatches of June 24 mentioned that there were then more than 2 feet of snow on the lofty Stelvio pass, where spirited fighting was going on. On July 1 it was reported that "the mountaineers (Tyrol) do not remember a season when there has been so much snow on the heights on July 1. The mountain streams, which are usually dry at the end of June, are now deep and almost impassable. The Italian troops are encountering snowstorms and thick fogs, which have interfered with long-range firing." Early in September we read that both Italians and Austrians were preparing for important battles "before winter." The winter fighting along the Austrian-Italian line will have to be done on the lowlands. The higher mountains will be impossible battle-grounds. Snow was falling in the Alps toward the end of September, interfering with the campaign.

It was to be expected that the weather conditions over the western theatre of war would have but little effect during the summer, for this is not a season of heavy rains, or of violent storms, or of intense heat, in that region. There seems to have been but one direct reference to the heat, and that was during the desperate fighting in the "Labyrinth," late in May and early in June. The sun was then so hot that the men fought bareheaded and without their coats. Late and apparently heavy spring rains fell about the middle of May. The ground became water-soaked and slippery. Trench fighting, which was active in the early part of this spell of bad weather, gradually came to a stop. Cannon firing was impossible (May 19) owing to the thick mist. Occasionally, at other times through the summer, rain and fog interfered with military operations in the western zone.

The summer "dry season" of the Mediterranean region made itself felt in the Gallipoli Peninsula. "No rain since June"; "water quite inadequate" to the needs of the troops; "unbearable dust"; are reported from there. Doubtless the troops suffered greatly from the dust, if not also from thirst. The autumn rains are sure to bring relief in these respects. On the other hand, the approach of these autumn storms has doubtless spurred on the Allies to try to force the Dardanelles before the high winds and rough water interfere with their naval operations. With the wind in certain quarters, no landing on the Gallipoli Peninsula has been possible.

As predicted by the writer early in April*, German Zeppelin raids against England became much more frequent as the more favorable weather of late spring and summer brought better conditions for air navigation. The

**Journal of Geography*, June, 1915. Vol. XIII, p. 315.

damage and the loss of life caused by these raids seem so far to have been very slight, the reason doubtless being that the attacks are usually made on dark nights, when landmarks are hard to make out. As during the winter, cloudy or "foggy" nights seem to have been selected for several of the Zeppelin attacks. Unfavorable weather did not always ensure safety to the English. Thus, a London despatch of August 10 noted that "the continual bad weather which has been prevailing in England would, it was believed, prevent the Zeppelins from coming last night." They came, however, in spite of what was reported as "a big storm on the east coast." The night was dark, and there was a thick fog, so that flying by the English defending aeroplanes was very difficult. On another occasion, a despatch from Holland reported the passage of four dirigibles on their way to England. These turned back, however, probably because the night was too clear. On Aug. 18 Zeppelins raided the eastern counties. English air patrols were active, "but owing to the difficult atmospheric conditions the Zeppelins were able to escape."

In mid-July (13th), 35 French aeroplanes raided Vigneulles-les-Hattonchatel, an important German strategic station, under the greatest difficulties. The wind was reported to be 40 miles an hour (?). The destruction of the aeroplanes was imminent, and the airmen had to drop down within close range of the German anti-aircraft guns in order to make sure that the bombs would not be diverted from their course by the gale. This is a point of unusual interest. On July 30 a squadron of 45 French aeroplanes set out to bombard some German petrol works in Alsace. "A cloudy sky and many mist (fog) banks" prevented some of the squadron from reaching their destination, but the rest did their work satisfactorily, and all came back safely. A very similar experience attended a raid of 32 French aeroplanes against Saarbrücken, the sky being cloudy and the valleys concealed under a heavy fog. Early in August (2nd) a French captive balloon was torn from its anchorage during a thundersquall, and was captured within the German lines. It is significant that the Zeppelins have recently been repainted, a leaden gray, like the war paint of our battleships, so that they may not easily be seen when flying under clouds. This is a good illustration of man's adaptation of his own inventions to the meteorological environment in which they are used.

In connection with the German military meteorological service which has been of such very great importance to the German Armies from the beginning of the war, it is worth while to note, at this point, what happened in Belgium last August (1914). These facts are taken from the Belgian *Gazette astronomique*, now published in England (No. 9, 1914, published in April, 1915). The Belgian Observatory at Uccle was made a "field weather station" of the German army on Aug. 20, 1914. Similar stations have been established at Liege, Namur, and at points on the coast. Under a military escort, four German meteorologists at once moved into the observatory, and began observations, both of surface conditions and of the upper air currents. The latter observations were made by means of ordinary pilot balloons and of electrically lighted balloons at night. The results were telegraphed to the

Deutsche Seewarte, in Hamburg. In November, 1914, the Uccle Observatory was made the "field weather center," i. e., it became the headquarters of all the German field weather stations on the western front. Some of the Belgian astronomers who stayed at the observatory have been allowed to continue their work. All the regular meteorological work at Uccle, including the publication of the daily weather maps, has been stopped.

The use of asphyxiating gas by the Germans has given a new and peculiar importance to the weather factor in the Great War. The whole relation between the amount of gas to be liberated and the wind conditions, both as to direction and velocity, seems to have been worked out by the Germans with the greatest care. If the wind is too strong, the gas is too widely diffused. If the wind is variable, or if there is a calm, the user of the gas is himself liable to be asphyxiated. But when the wind is steady, of moderate velocity, and in the right direction, the fumes spread out over the ground like a low fog, and do their deadly work. There are reports of but two cases in which the Germans were themselves forced to retreat before their own gases, owing to a change in the wind. As a rule, we may be certain that the gas was not used unless the meteorological observers with the German armies gave reasonable assurance of favorable wind directions and velocities. Europe is in a zone of prevailing westerly winds. It is clear that when the Germans used gas along the western battle front, they waited for rather gentle northerly, northeasterly, or easterly winds, such as may be expected in that region when there is somewhat higher pressure to the east. On the eastern battle-line, on the other hand, gentle westerly winds, have on the whole been the favorable ones. The most favorable wind direction at any point depends, of course, upon the trend of the battle-lines at that particular place. Much attention has been given by the Allied commanders to methods of meeting gas attacks. The suggestion has been made that a counter-current of air should be produced, by fans driven by gasoline, in order to drive back or lift up the cloud of poisonous gas.

On the naval side of the war there have been some incidents worth recording. In the British naval attack on the Belgian coast towns (held by Germans) in August, the ships took advantage of the morning fog; came closer inshore than would have been possible in clear weather, and were able to defy any effective reply from the Zeebrugge garrison. In the naval action of the Baltic early in July we learn that the Germans also took advantage of a dense fog in order to come closer to land. The Russians had great difficulty in seeing the enemy, and their fire was inaccurate. In order to protect a German mine-layer, which was in distress (Petrograd report), the German torpedo boats tried to assist her escape by throwing volumes of thick black smoke out of their funnels, thus making the fog even more dense.

The importance of securing an ice-free port for Russia is one of the great strategic problems of the war. Archangel is fast becoming a very busy port, but its use is greatly limited because it freezes up in winter. Russia has lately bought some new ice-breakers and hopes to keep the harbor open much later than usual. But a port on the south, open the year around to the

world's commerce, has long been Russia's supreme desire. And in her present military situation it is almost a supreme necessity. This gives the opening of the Dardanelles and the Bosphorus before winter an importance which the Allies have long recognized, and have evidently put forth their utmost efforts to attain. The fall of Libau, early in May, was a serious loss to Russia.

Preparations for a second winter campaign were begun in July and August. A Berlin dispatch, dated July 26, reported that the army authorities announced officially "that the requirements in the way of warm underclothing, gloves and wristlets for the German soldiers' use in an eventual winter campaign have been amply covered." A report from the Hague said that the German "grass green" uniforms of summer are to be replaced by field-gray for the winter. Thus does man adopt protective coloring devices depending upon the season. A Paris despatch of Aug. 31 mentioned France's preparations for the winter. And one from Budapest, Aug. 24, says: "Great efforts are being made for a winter campaign. Last winter's experience proved sickness and frostbite are dangerous enemies, and in consequence large orders have been placed for wool-lined coats and thick woolen boots. All tailors and clothing houses are busily engaged in preparing the winter clothes of the soldier." Italy, also, has made her preparations for the winter. Our own manufacturers of heavy clothing, knit goods, hosiery and footwear long since received orders for supplies of winter clothing for the European armies.

UNITED STATES LEADS IN EXPORTS

For the first time in its history the United States leads the world as an exporter. Occasionally it has surpassed the United Kingdom in the exportation of domestic products, but it was only in the fiscal year ended June 30, 1915, that the total American exports, domestic and foreign, exceeded those of the United Kingdom.

The total exports in the fiscal year 1915 aggregated \$2,768,600,000, as against \$2,170,100,000 for the United Kingdom, the figures representing in the case of the United States an increase of 17 per cent, and in the case of the United Kingdom a decrease of 30 per cent when compared with last year.

American exports in the fiscal year 1915 included domestic products to the value of \$2,716,200,000, against \$2,329,700,000 in 1914; and foreign products, \$52,400,000, against \$34,900,000 in the preceding year. British exports in the same periods included British and Irish produce, \$1,744,100,000 in 1915, against \$2,557,200,000 in 1914, and foreign and colonial produce, \$426,000,000 in 1915 compared with \$526,500,000 in 1914.—[*Commercial America*.]

HOME MADE MAPS AND ATLASES

By Robert M. Brown

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BECAUSE of the lack of funds many teachers, especially those in rural communities, are deprived of the use of good maps for work in geography, history, literature, etc. In many instances the one or more maps which form a part of the equipment of the school, are legacies from the time when ideas concerning wall maps were crude and illogical, so that they offer little incentive to fresh and vigorous work. In the present days when teacher-training is so extensively demanded, it is within the bounds of reason to expect of the newer generation of teachers a broader view of their craft, and ingenuity enough to improve the equipment and surroundings of most school rooms. In the decoration of the school room, in the improvement of school exteriors, in devices for seat-work in elementary grades, and in the appliances for nature study, a great advance has been made. If the activities so well inaugurated in these lines could be spread over all the branches of the curriculum, the result would be remarkable.

Board work has become a usual achievement and it is common to find elaborate designs of calendars, of illustrations of stories, and of decorative emblems on the blackboard. It is only a step further to the construction of a good blackboard map. The step is not an advance in skill so much as in a knowledge of what constitutes a good map. First, it is necessary to put upon the board or upon paper, if the map is to be preserved, an outline of suitable size. There are a number of methods which may be used, but for most purposes the use of coordinate lines is the simplest. Draw squares of any convenient size, as for instance one half inch, over the map to be enlarged. Then on paper or on the blackboard lay off the same number of squares of two, four, or six times the length. Finally square by square draw in the enlarged network the map as it appears in the smaller network. Not only may the outline be drawn on a larger scale in this way but the locations of important cities, the boundaries of physiographic provinces, and the position of railroads may likewise be transferred. The network thus drawn is purely arbitrary and the squares are of no value after serving the ends stated; consequently they should be drawn with light strokes and erased when the map is done. The parallels and meridians on a map would serve as well as the squares but the inequalities of distance and especially the curvatures in many cases do not render them easily susceptible to enlargement.

With an outline of proper size to use as a wall map, the topographic features of the country may be inserted. It is assumed that a topographic map is more valuable than a political map, or rather, that a topographic map which shows political divisions is much more legible than a political map which shows topography. Topography may be inserted in color by the use of colored crayons. A three-fold scheme for the land, lowlands below 500

feet, uplands, 500 feet to 1650 feet, and highlands above 1650 feet, with water colored blue; or a four-fold scheme, dividing the area above 1650 feet into highlands, 1650 to 6500, and mountains, above 6500, may be used. The colors should be as uniform as possible since they are in themselves meaningless, and ease in reading maps can only come as symbols become widely used and agree in character. Consequently it is well to strive to imitate the shades of the best maps and those in general use are green for lowlands, a light brown for uplands, a darker brown for highlands, and a very dark shade for mountains. Crayons frequently give two shades of brown, a burnt sienna and a burnt umber. A light application of the former for uplands and a heavy application of the umber for mountains form a good combination. In the newer maps which strive to follow a uniform scheme of color, there is the greatest discrepancy in the use of the color for upland areas; some publishers preferring a yellow, others white, and still others a buff color. A widely accepted scale of coloring, although too elaborate for the neophyte to adopt, may be found on the sheets of the 1:1,000,000 map of the world, a number of sheets of which have been issued by the United States Geological Survey at Washington. When the topography map is completed, upon it as a base, boundary lines may be drawn in heavy red lines.

The chief danger in work of this sort lies in the crudeness of the product. Colors put on without a sense of values may give erroneous impressions and over-emphasize one area at the expense of another. This danger, however, can be shunned as the experiences multiply, and at its worst, it cannot be more serious than results from the bizarre history charts generally accepted by school authorities.

It is probable that a teacher undertaking a task of this nature for the first time will over-estimate the value of her first product and take greater pride in it than in later, more finished works. She should therefore submit it to fair criticism and test its efficiency constantly, and by repeated trials a map may be produced that will be of good pedagogical value. Maps of other countries may be added until a very creditable series of maps is obtained.

In many schools a great handicap to good teaching in geography results from the absence of a good topography map, and in others from ignorance concerning the use of such a map. Pupils have been led to learn laboriously the paragraphs on physical features and climate, and from these a recitation is afterwards demanded. The painful attempts on the part of the pupils to visualize the printed page contrasted with the training which results from formulating into words his impressions of a good map are unworthy of our schools. An English writer* states that the general sequence of cause and effect in geography may be divided into (1) a few preliminary climatic principles, and (2) a mode of applying these to particular countries. There is no reference here to topography but it is implied in the text that the school possesses and will use maps showing the physical features. In addition to the map showing the divi-

*Archer, *The Teaching of Geography in Elementary Schools*.

sion of the land into lowlands, upland and highland, a climatic map may be made to show the annual distribution of rainfall (in varying shades of blue) and the temperature of the January and July isotherms. With the location of important centers on the topography map in large black dots the two maps will form an adequate background for good elementary work in the geography of the area.

Most of the original sources for the construction of these maps are beyond the reach of the majority of teachers, but generalized products from them may be had without great inconvenience. Text books furnish topography and rainfall maps of grand divisions, but for the minor divisions the teacher will be able to borrow one of the many small school atlases, such as the Longman's *New School Atlas* or the Sydow-Wagner's *Schul Atlas*. Some of the requirements for wall maps were published in the *Journal of Geography* recently*.

A reference atlas, if no such volume is at hand, is not beyond the scope of the teacher's ability. Maps are being published today in great quantities, and railroad and steamship lines spread them widely. Papers and magazines illustrate articles by maps, many of them of small areas but a few of more extended lands. Plan an atlas of a loose leaf type so that it will be possible to insert maps from time to time as they are available. In putting the sheets together it would be well to follow the order of regulation atlases; a map of the world may be obtained from any one of a number of steamship lines, or for this and the maps of the continents, the pages from a discarded text book may be pasted on to the atlas sheets. Watch the magazines and papers for detailed maps; use railroad folders freely and it will be surprising how soon the blank spaces are filled. In this as in all map dealings discrimination has to be practiced. The teacher must appreciate that every published representation of an area is not worthy of a place in the school room. Some railroad maps, for instance, so distort the shape of the country that they are misleading and many of them over-emphasize the straightness as well as the importance of their respective lines. In using old maps, it is advisable to make sure that no change in the boundaries of provinces has been made. An example of this may be found in Canada, where, during a number of recent years, changes have been made in the provincial boundary lines, the last revision being in 1912. An atlas of this kind could be used as a record of current changes. Most teachers read some paper covering the topics of the day and are constantly reminded of the changes in importance of towns, in industrial centers, and in political boundaries. A teacher should have some way of recording these data, for in a year or so the maps of the newest text book are frequently out-of-date. Thus with the practice of very little ingenuity and with a modicum of skill, a school may be equipped with a creditable series of wall maps and a reference atlas which is the latest thing out.

*Notes on Wall Maps, Vol. XII, No. 7, p. 208. March, 1914.

THE RANGE AND TOWNSHIP PLAN OF ROADS

THIS scheme of north-south and east-west roads prevails so widely in the central United States that it will probably surprise the people to know that main travel in those regions has never followed the plan and that it cannot be regarded as at all satisfactory.

In places that have been long settled roads lead as directly from one center of population to another as is allowed by the obstruction offered by ponds, swamps, and hills. If one place lies seven miles northeast of another, you travel a little over seven miles between them on a road that is constantly swinging a little from side to side on one general direction. If the neighborhood be hilly, the deviations from the direct course may lead to all the directions of the compass. In Michigan and other parts of the interior, in order to reach a point seven miles away to the northeast, theory calls for five miles east and five miles north. All the rural districts of the West are laid out in such mile-wide meshes of roads. To satisfy the scheme over three-quarters of the roads there run north-south or east-west. Country people are so used to these roads that angling ones, or roads that have taken on a meandering habit from association with streams, are regarded as exceptional and lawless. As a matter of fact roads between points of real importance always do angle unless they may be connected by east-west or north-south lines. The rectangle roads are only in actual use in thinly-inhabited country districts a little off main lines of travel. A good illustration is the district in Michigan just southwest from Lansing, the capital. From Lansing a road runs obliquely to the southwest for forty-five miles to Battle Creek. This is crossed near its middle, at Charlotte, by another running obliquely from southeast to northwest, from Jackson toward Grand Rapids, although the dominant road-pattern of the whole district is the one-mile square. And the same thing is true of all points of real importance. Roads run pretty directly between these in the Middle West just as in the East. The Range-Township system prevails mainly in the rural districts. It does, however, tend to introduce undesirable jogs into fairly direct roads. A striking example of this is the *West Michigan Pike*, between Montague and Shelby. The road has eleven turns in it, all square corners. Shelby is due north of Montague, fourteen miles away and eleven miles of the direct north road is laid out as road, but none of this is followed by the *West Michigan Pike*, which makes three miles westward in three stretches of different lengths, fourteen miles northward in six stretches, and three miles eastward in three more, a total of twenty miles.

The fact is the Range-Township system is not a system at all but a system of land surveys and the simple means of numbering and describing unexplored lands, and of locating points on the ground. With one or two more miles of road in a state, every point may be described by its location on the grid. It is not enough to put in the roads of the Range-Township system.

apportions them evenly among owners and provides an abundance of them. But this procedure makes no provision for the characteristics that should belong to a good road. The convenience of the survey does not extend to the roads.

A road should lead as directly as possible to its destination. All its deviations from the straightest possible course are defects. The nature of the ground compels some deviations, but to plan them as a part of a survey system is to make the roads worse in order that the survey may be simpler or more convenient. The rectangular road system as a part of a survey was first used by the old Romans on the plains of the Po, but without north-south, east-west alignment. The settlers in southeast New Hampshire tried to use it in granting lands between Exeter and Lake Winnepesaukee, as may still be seen in that region on many an abandoned weather-gullied roadway straight up and down almost impossible hills alongside the less direct, but better graded modern highway. The Canadians use a similar system in Ontario with squares of 1000 acres and roads parallel and perpendicular to the Lake Shores. As a system of surveys it has been of great convenience in settling the middle west. As a system of road planning it is only tolerable for roads of little use.

Mark Jefferson.

TO TEACHERS OF GEOGRAPHY IN WISCONSIN

Mention has been made in the Journal of Geography of a movement of leading geographers to form a National Council of Geography Teachers. To this end, a representative committee designated the Inaugurating Committee is at work. Professor George J. Miller of Mankato, Minnesota, is chairman. In order to facilitate the work of organization, an appointee in practically every state in the Union has been named to assist in forming State Councils of Geography Teachers, such State Councils to be organic parts of the National Council. During the session of the Wisconsin State Teachers' Association in Milwaukee, the regular meeting of the Geography Association of Wisconsin will be held. A program is now being arranged by professors Lucius T. Gould of Milwaukee Normal and Professor R. H. Whitbeck of the University. Nearly all the members of the old Association are in favor of combining, in one organization, the present Association and the State Council. There are some excellent students and teachers of geography in the Badger State, and the time has come when concerted action of this body must be pronounced in order that it may be influential. Wisconsin should have one of the best State Councils in the Union; the talent is in the state to accomplish this end. All teachers and students of geography are cordially and earnestly invited to attend the Association meeting in Milwaukee, announcements of which will be forthcoming.

W. J. SUTHERLAND,
Chairman State Council.

GEOGRAPHICAL MATERIAL ON CANADA

THE PHYSICAL FEATURES AND THE NATURAL RESOURCES OF CANADA*

THE area of the Dominion of Canada (3,730,000 square miles) is somewhat greater than that of the United States including Alaska, and rather less than that of Europe.

In Canada, as in every other country of the world, the physical features have played, are playing and will continue to play a most important part in the development of the history of the country and the character of its people.

An enormous expanse of 2,000,000 square miles, representing more than half the whole area of the Dominion of Canada, forms a rugged and, for the most part, barren tract, which, driven down like a wedge into southern Canada, separates the older settlements of eastern Canada from the new provinces of our West. It cuts Canada in two and has in this way exerted a most potent and in some respects a sinister influence on the development of our Dominion. The cost entailed in building the line of the Canadian Pacific railway across this barren tract of country for the purpose of uniting eastern and western Canada was enormous, and few better examples of the influence of the physical features of a country upon its development and history can be cited than that of this ancient protaxis upon the development and history of Canada.

WATER POWERS

It is doubtful if there is any country in the world which is so abundantly supplied with water-powers as the Dominion of Canada. The total water-power which is available for use cannot yet be calculated, but it is enormous. The following table, however, gives the number of horse-power which had been developed from the water-powers in our several provinces in the year 1911. This will of course be immensely increased as years go on.

Horse-Power		Horse-Power	
Ontario	532,266	Saskatchewan	45
Quebec	300,153	Alberta	7,300
Nova Scotia	15,272	British Columbia	100,920
New Brunswick	9,765	Yukon	2,000
Prince Edward Island	500		
Manitoba	48,300	Total for Canada	1,016,521

MINERALS

The mineral deposits of Canada are of great extent and importance. The mineral output is increasing very rapidly and in the year 1913 had a value of \$144,000,000. Our coal resources, as shown by the investigations undertaken in connection with the International Geological Congress which was held in Canada last year, are in extent second only to those of the United States.

*Extracts from the Presidential Address of Prof. Frank D. Adams of the Royal Society of Canada, 1914.

The geological structure of the Dominion, moreover, is such as to lead to the confident belief that as detailed exploration is carried forward in northern Canada, large deposits of the metallic minerals will be found in that portion of the Dominion, so that the mining industry of the Dominion, there is reason to believe, will play a very important part in the future history of the country.

AGRICULTURE

Agriculture is and must always remain the chief industry of the people of Canada. The population which the Dominion can support in the future will depend chiefly upon the area of land suitable for farming which exists in Canada and the manner in which this is cultivated.

The fact that Canada occupies more than half of the continent of North America and has an area almost identical with that of Europe is sometimes mentioned as carrying with it the implication that it would afford support to an almost unlimited population.

It is impossible at the present time to arrive at an accurate estimate of the actual area of arable land in the Dominion, but there is practically no land which can be properly cultivated in that portion of Canada which lies north of the area covered by a forest growth; with the possible exception of the clay belt in northern Ontario, there is no part of "the Canadian shield" which can support more than a very sparse farming population or in which farming can be made a really profitable industry. The area of arable land in British Columbia, as compared with the size of the province, is quite small.

There are only two great areas of land capable of continuous cultivation throughout their entire extent and of thus supporting a large agricultural population. The first of these is the plain lying between the southern margin of "the Canadian shield" and the boundary line of the United States, in Quebec and Ontario, extending from the hilly or mountainous district of the Appalachian folding in eastern Quebec to the Great lakes. The second is the southern portion of the plains in the provinces of Manitoba, Saskatchewan and eastern Alberta. These are classed together as the Great Plain of Central Canada, and include upwards of 470,000 square miles of farming and grazing lands.

FOREST PRODUCTS

The forests of Canada were its chief source of revenue in the early days of the settlement of the country. Year by year great rafts of timber were floated down the St. Lawrence and Ottawa rivers past Montreal and were loaded on fleets of ships at the port of Quebec. Later, with the advent of railways, the same lumber was brought in immense quantities by rail to Montreal or shipped directly to its market in the United States.

The following figures show the yield of products of the forest (wood) annually for census years going back to 1870, expressed in feet board measure:

	Feet Board Measure
1870	2,951,134,352
1880	6,174,605,544
1890	5,529,993,716
1900	4,131,702,968
1910	5,696,537,260

A careful study by the official forester of the Dominion shows that the reserves of merchantable soft timber in the forests of Canada are only between one-fourth and one-fifth of that remaining in the forests of the United States. Of these reserves in Canada, about one-half are in the old provinces of eastern Canada and the other half in British Columbia.

It must be borne in mind that while a large part of Canada is covered with forest, much of this is a woodland country rather than a country covered with a forest which produces considerable supplies of merchantable timber.

One authority states that the area of land which is used for farming and grazing purposes in the Dominion at the present time may be set down at 50,000,000 acres and that a conservative estimate would make the area available for these purposes six times as great, that is to say, 300,000,000 acres or about 470,000 square miles. This estimate, which includes not only farming but grazing land, is probably too low.

THE FISHERIES OF EASTERN CANADA*

The fisheries of Eastern Canada fall into two distinct divisions, the deep-sea and the in-shore or coastal fisheries.

IN-SHORE FISHERY

The in-shore fishery is the more important of the two, inasmuch as it employs about eight men for one that is employed in the deep-sea fishery. It is carried on in boats carrying two or three men, and at a distance of from one to five miles from the shore. A small class of vessels, carrying four to seven men, is also used on the nearer "banks" lying twelve to fifteen miles out; while many fixed fishing contrivances, such as traps, drag-seines, and weirs, are operated from the shore. Boats engaged in the hook-and-line fishery leave harbour about daybreak and return in the course of the afternoon, while vessels of the small class remain two days and sometimes a week on the fishing grounds before returning to harbour.

The kinds of fish taken from the in-shore waters are cod, hake, haddock, pollock, halibut, herring, mackerel, shad, alewives, smelts, flounders, swordfish, sardines, salmon, lobsters, oysters and clams. Herring is the chief bait-fish used in line fishing; but when these are scarce, clams are largely used as a substitute. Squid, a kind of cuttlefish, when obtainable, is a favourite bait.

*Abridged from a paper by J. J. Cowie, Department of Marine and Fisheries, Canada, in "Sea Fisheries of Eastern Canada," pp. 94-110.

OFF-SHORE FISHERY

The deep-sea or bank fishery is pursued in substantial fore-and-aft rigged sailing vessels of from 60 to 100 tons, carrying crews of from 12 to 20 men. Operations are conducted on the many shallow stretches known as "banks" which lie between the outer edge of the in-shore area and the deeper waters of the Atlantic, ranging from the "Grand Bank" lying southward of Newfoundland to "Browns Bank" off the western end of Nova Scotia, also on the many banks in the gulf of St. Lawrence, around the Magdalen islands, and between Cape Breton and Newfoundland. The fish are split and salted down in the hold of the vessels at the end of each day's fishing, and when the hold is full, or the supply of salt gives out, the anchor is hove up, and a course shaped for the land. The kind of fish taken by vessels on the off-shore grounds are cod, haddock, hake and halibut.

A STATIONARY CONDITION

In the course of the fifteen years from 1870 to 1885, a steady advance was maintained in the value and importance of the fisheries of our four eastern provinces. The value of all kinds of fish caught by the fishermen of those provinces during the former year amounted to over \$6,000,000, while in the latter year the value rose to no less than \$15,000,000. In all of the four provinces there were employed in 1870, on board of vessels and boats, 27,385 fishermen, while at the end of the fifteen-year period in 1885, the number had increased to 51,498. The aggregate value in 1910 shows an increase of only \$834,900 over that in 1885, while the increase in the number of men engaged only amounted to 683 in the course of a quarter of a century.

COD FISHERIES

Of all branches of the fisheries of the east, the most important is the cod fishery, and so far as money value is concerned, it remains the leading branch of the Atlantic coast fisheries. The counties along the south shore of Nova Scotia produce the largest quantities of this fish; but the majority of the fishermen of this district give their whole time and attention to fishing, and are in possession of a fine type of fishing boat. These facts account for their success in this as in other branches of the industry.

Of all the cod-fishing waters of Eastern Canada, probably the most prolific are those of the gulf of St. Lawrence, around the Magdalen islands, on the north and east coasts of Prince Edward Island, the north coast of Cape Breton and in Chaleur bay. In addition to this, the shores of the Gulf are rendered exceptionally advantageous for fish-drying, owing to their immunity from the fogs that sweep in upon the southern or Atlantic coast of Nova Scotia.

The catches of both the in-shore and the off-shore fishermen are mostly all split and salted for drying purposes. There is a vast difference, however, between the dried products of the two modes of fishing. Cod that is split on

board of a deep-sea vessel is heavily salted, in order to preserve it during the fishing voyage, which sometimes lasts a couple of months. On the other hand, in-shore fish are landed daily, split, and placed in salt for a short time only, then dried. To overcome the difficulty, caused by the frequent presence of fog on the shores of the bay of Fundy and on the southern shores of Nova Scotia, drying by artificial means has been resorted to. Drying by this process is accomplished in about forty-eight hours, as against three weeks by the sun and air process.

The chief markets for dried cod are found in Italy, Spain, Portugal, Brazil, the West Indies and the United States. The largest and best fish are sent to Europe and Brazil; and the inferior kinds to the West Indies. The total value of cod taken by the fishermen of Eastern Canada during the year 1909-10* amounted to \$3,847,844.

OTHER VARIETIES

Haddock, hake and pollock are taken largely by the in-shore fishermen while fishing for cod.

Halibut are usually found wherever cod are met with. The fishery is not, as a rule, prosecuted as a distinct one, the fish being taken in considerable quantities by the cod fishermen.

Herring.—Although the herring fishery falls below some others in money value, it is in some respects the most important of all the Eastern Canadian fisheries, inasmuch as the success or failure of the great hook-and-line fisheries depends to a great extent on the abundance or scarcity of the supply of herring for baiting purposes.

In the spring of each year, without fail, large masses of herring move close in to the shore, and are literally washed up on the beaches, in many parts of the gulf of St. Lawrence, especially. The mode of capture is by fixed trap and gill nets set close to the shore. The spring herring is poor in quality; but it provides an abundant supply of fresh bait for the cod fishing fleet in its first voyage to the "banks," while much of it is salted and stored for baiting lobster traps throughout the lobster fishing season. In the summer and fall, herring of an extremely fine quality abound; but they do not come so near the shore as in the spring, and, as a consequence of the use of the same fixed fishing gear, the summer catch is a small one.

Sardines.—A very important sardine fishery is carried on in Passamaquoddy bay, New Brunswick, and the waters around the islands of Grand Manan and the West isles at the mouth of the bay of Fundy. It is the only one of its kind in Canada. Strictly speaking, the fish is not a sardine at all, but simply a young herring.

This fishery has been the means of building up a notable canning industry in the course of the last thirty years. When the canning of these fish com-

*This refers to the fiscal year ending March 31, 1910. Elsewhere in this paper, also, the year 1910 means the fiscal year 1909-10.

menced, considerable quantities were canned in establishments on Canadian soil; but the United States, being the chief market for the canned sardines, the government of that country, by placing a prohibitive duty on the manufactured article, while granting free admission to the raw material, practically transferred the canning industry from Canada to the nearby towns of Eastport and Lubec in the state of Maine; so that now the fish are supplied by Canadian fishermen from Canadian waters, and canned mostly on United States soil.

Mackerel.—The mackerel fishery is a very important one on all parts of the seaboard of Eastern Canada. While little of an accurate nature is known concerning the annual appearance and disappearance of mackerel, it is well known that they appear annually off the mouth of the bay of Fundy about the middle of May, and at various points on the coast of Nova Scotia as the season advances, until in June they swarm into the Gulf. From that time they are found more or less abundantly until the early part of November, when they disappear entirely from Canadian waters.

Seal.—Although seal hunting can scarcely be classed as a branch of the fisheries, nevertheless, being part of the resources of our eastern seas, it may be mentioned, in passing, that in the gulf of St. Lawrence—chiefly around the Magdalen islands—an important seal hunt is made annually on the ice in the spring. In a good year as many as 40,000 seals are killed and landed at the islands.

Steam Trawling.—Since 1908, steam trawling, the latest and most successful mode of capturing large quantities of fish ever put into operation, has been tried in a small way on the coast of Nova Scotia. This method consists in the dragging, by a steam vessel, of a strong, bag-shaped net over the seabottom, for the capture of all kinds of fish.

It is a fact that wherever this style of fishing has been introduced, it has been denounced in the most decided manner by fishermen who use hooks and lines. Trawling is an expensive mode of fishing, and requires a large and ready outlet for all kinds of fish in their fresh state, at good prices, the price of salt fish being generally too low to permit of profitable working for that trade alone.

Our cod, haddock and such fisheries are gradually undergoing a change from preponderating salt-fish businesses to fresh-fish ones. Boat fishermen have become alive to the fact that, in order to meet the demands of the rapidly growing fresh-fish trade, they must be able to reach port from the fishing grounds with their perishable cargo in the shortest possible time; and so today we find no fewer than 2,304 boats belonging to the eastern fishery fleet fitted with gasoline engines, and in a position to make speed through head winds and calms.

THE LOBSTER FISHERY OF CANADA*

Advent of the Cannery.—The lobster fishery in Canada was of no importance until the time of the introduction of canning. Canning was introduced into Canada from the Northern United States, apparently in the latter part of the sixties. Even at that early date the lobster fishery in the coastal waters of the Northern States was in a seriously depleted condition owing to the intensive fishing that had been carried on, and those who were engaged in it saw in the Canadian fishery a magnificent opportunity of continuing their industry. At that time lobsters were very abundant all along the five thousand miles of Canadian coast line from Passamaquoddy bay to Labrador. In fact, they were found inshore much earlier in the season than they are now, no doubt being driven there for food. It was not an uncommon thing after a heavy storm to find windrows of lobsters stranded on the coast. These were merely carted away by the farmers for fertilizer. It is not surprising, under these conditions, that when a method became known whereby these lobsters could be made available for human consumption, could be put up in such a way that even upon remote sections of the coast they could be turned into a desirable marketable article, the method spread with great rapidity. In 1869 when canning was nicely started in Canada there were 61,000 one-pound cans put up. The very next year the quantity increased to half a million, and in 1871 it went up to over the million mark. Ten years later it reached its zenith with a pack of over 17,000,000 pounds. From that time on there were the usual ups and downs in the catch, owing to weather conditions generally; but the trend was downwards until about 1898, when the production was somewhere about the 10,000,000 pound mark, and by 1909 it had still further declined to 9,000,000 pounds. For about ten years it was stationary, and arguments began to be forthcoming that the time had come when the lobster fishery had reached a state of equilibrium, that it would not increase or decrease any more, but that natural reproduction would keep up the supply.

FUR FARMING IN CANADA

A report entitled *Fur Farming in Canada* was prepared in 1913 by Mr. J. Walter Jones. It deals with the various species of fur-bearing animals in Canada, but special attention is given to the fox-farming industry in Prince Edward Island. It is the first book of its kind ever published in Canada and the demand for it has been so great that the supply is exhausted.

Phenomenal activity took place in the fur-farming industry in 1913, especially on Prince Edward Island. Down to the present year, there were no statistics available. But, at the last session of the Prince Edward Island legislature, provision was made for imposing a tax of one per cent upon the value of the young foxes born from year to year. Under the provisions of this Act, an enumeration was made in August last of all the fox ranches and the foxes in

*From the report of W. A. Found, Supt. of Fisheries of Canada.

captivity on the Island, together with a sworn valuation of the young foxes reared this year.

As a result of this census, it was found that there are 233 fox ranches. In these ranches, 2,480 foxes of all grades are in captivity, of which 1,325 are classed as silver-black. The sworn valuation of the young foxes this year was slightly over \$3,700,000.

The development of the fur-farming industry in Canada has been remarkable. As a legitimate industry, it is profitable in the extreme and capable of very great expansion and variation. While all persons who engage in this industry cannot expect to reap the enormous profits which some in Prince Edward Island have realized, it remains an undoubted fact that the supply of fur taken from animals in a state of nature is constantly diminishing and that there is a continuing and never-failing market in the world, at high prices, for high grade furs. These furs can only be produced under certain climatic conditions. It is nature that clothes the animal with the valuable coat of fur suited to its environment. This environment is found in the natural conditions of Canada. To reap the profits of our geographical and climatic advantages, all that is necessary is to exercise the same care and judgment that would be requisite in any other line of production.

The number of farms in Canada on which these animals are kept has greatly increased. If one were to look over the statistics from the various provinces, one would find that there are licenses in Nova Scotia for possibly one hundred and fifty fur farms; in New Brunswick, for a similar number and in Prince Edward Island, the number has probably increased three-fold or four-fold during the year, while in all the other provinces of Canada fur farms have been established. In the main, however, the industry is centred in Prince Edward Island, and for a long time to come, people the world over, who desire high grade breeding animals will come to the Island for them. So that in addition to the fur business the farmers of the Island are engaged in supplying breeding animals to stock other farms.

A question often asked is: How long will the fox farming industry last? So far as the breeding of silver foxes is concerned, it would depend upon what price the fur would bring when the pelts are placed on the market.

The whole basis of this industry rests upon a continuance of the demand for furs. It is well known that furs of good appearance are extremely scarce at present. Nearly all the stocks of furs today are comprised of cheap skins, dressed and dyed. A few staples may still be had, but these are rapidly becoming mere specialties, such as silver fox, chinchilla, Russian sable and broad-tail. Mink skins were worth fifty cents each ten or twelve years ago; today, they are worth \$6.00 each. Speaking generally, it is safe to say that the price of furs has advanced three hundred per cent in 15 or 20 years. The world buys about \$350,000,000 worth of manufactured furs annually.

The black and dark silver prime skins from foxes of Prince Edward Island sell in London for as high as \$2,000 each. As high as \$35,000 is paid for a pair of the best quality breeding black foxes.

FROM THE JOURNAL OF A FACTOR IN THE HUDSON BAY COUNTRY

In "A Summer and Winter on Hudson Bay," C. K. and A. T. Leith reproduce a highly interesting portion of the day journal of one John Clark, factor of the Hudson Bay Co's. post at Little Whale River. Only portions of the record are here reprinted, the purpose being to show the great number of fur-bearing animals caught by four or five men. The journal is for the winter of 1876-1877, "a great fox year."

Nov. 1—Shot 9 white foxes.

Nov. 2—15 foxes and a wolverine.

Nov. 4—8 white foxes, 1 blue fox, 1 red and 1 cross; total, 11.

Nov. 8—"I got 9 partridges and 4 white foxes; Adam 7 partridges; David 20 partridges and 5 white and red foxes; Swanson 6 white foxes; Moses 16 partridges."

Nov. 9—David and self got 21 white foxes and 1 blue fox.

Nov. 10—Total for me today, 20 foxes; David, 17; Adam, 6.

Nov. 11—David got 14 foxes; Swanson, 8; Adam, 3; self, 11.

Nov. 12—The men got 50 white foxes between them.

Nov. 13—I got 18 white foxes; Snowboy, 3; David, 11.

Nov. 14—The men got 30 foxes from their traps.

Nov. 15—The men got 24 foxes from traps.

Nov. 16—David got 30 foxes; Adam 16; Swanson 4; Moses 6; and they got 4 from my traps.

Nov. 17—David got 6 foxes, and self, 13.

Nov. 18—David got 8 foxes; Moses 10; Adam, 2; Swanson and self, 34.

Nov. 20—I got 26 white foxes.

Nov. 21—I got 13 white foxes.

Nov. 23—I got 8 white foxes in traps, and shot 11 white and 1 blue fox; total 20. "The men get foxes morning and evening so I can keep no track of the number they get."

Nov. 25—Self got 15 white foxes from traps and shot 26.

Nov. 27—Self got 12 foxes from traps and shot 3.

Nov. 30—Self got 5 white foxes from traps and shot 15.

* * * * *

April 6—Between us, self and four servants, we have 5 silver, 9 cross, 15 red, 11 blue and 1235 white foxes, the best hunt ever made by the servants at this place.

April 28—Over 9,000 white foxes now on hand.

The strip of land along Hudson River from New York City to Cohoes, including Bergen and Middlesex counties, N. J., is the greatest brick-making district in this country, and probably in the world. New York City is the leading common brick market in the United States, about a billion bricks being used there annually, the principal source of supply being the Hudson River region.

TEST YOUR KNOWLEDGE OF AMERICAN CITIES

THE following table gives the name of the largest city in each state. Cover the column containing the names of the cities, and test yourself on the list:

State	City	Pop. in 1000's in 1910	State	City	Pop. in 1000's in 1910
Ala.	Birmingham	133	Nebr.	Omaha	124
Ariz.	Tucson	13	Nev.	Reno	11
Ark.	Little Rock	46	N. C.	Charlotte	34
Calif.	San Francisco	417	N. D.	Fargo	14
Colo.	Denver	213	N. H.	Manchester	70
Conn.	New Haven	134	N. J.	Newark	347
Del.	Wilmington	87	N. M.	Albuquerque	11
D. C.	Washington	331	N. Y.	New York	4,767
Fla.	Jacksonville	58	Ohio	Cleveland	561
Ga.	Atlanta	155	Okla.	Oklahoma City	64
Ia.	Des Moines	86	Ore.	Portland	207
Ida.	Boise City	17	Pa.	Philadelphia	1,549
Ill.	Chicago	2,185	R. I.	Providence	224
Ind.	Indianapolis	234	S. C.	Charleston	59
Kans.	Kansas City	82	S. D.	Sioux Falls	14
Ky.	Louisville	224	Tenn.	Memphis	131
La.	New Orleans	339	Tex.	San Antonio	97
Mass.	Boston	671	Utah	Salt Lake City	93
Md.	Baltimore	558	Va.	Richmond	128
Me.	Portland	59	Vt.	Burlington	20
Mich.	Detroit	466	Wash.	Seattle	237
Minn.	Minneapolis	301	Wis.	Milwaukee	374
Miss.	Meridian	23	Wyo.	Cheyenne	11
Mo.	St. Louis	687	W. Va.	Wheeling	42
Mont.	Butte	39			

NOTES ON AMERICAN CITIES

Massachusetts has 293 manufacturing establishments each of which makes upwards of a million dollars' worth of products a year. The 16 southern states all together have only 297, or 4 more than the little state of Massachusetts. New York has 470 such establishments, while the 22 states west of the Mississippi have 452, or 18 less than New York alone. Of the 3060 such concerns in the United States, 1875, or over 60 per cent, are in six states, New York (470), Pennsylvania (400), Massachusetts (293), Illinois (273), Ohio (245) and New Jersey (194).

Five states of the Union (Ark., Del., Md., Mont., Ore.) have only one city each with over 25,000 population, while Massachusetts alone has 25 such cities.

The United States has 50 cities of over 100,000 population and 29 of them are north of the Potomac and Ohio, and east of the Mississippi.

New Jersey has 14 cities ranging from 30,000 to 350,000 population and 11 of them are within sight of the tower of the Metropolitan building in New York.

New York has 9 cities of over 50,000 population and all of them are on the Erie Canal-Hudson River waterway.

Over 90 per cent of the people of Massachusetts, Rhode Island and Connecticut live in cities of 2500 or more population, but less than 15 per cent of those of North Carolina, South Carolina, Mississippi and Arkansas. In 14 states the urban population constitutes over 50 per cent of the total. It is not a little surprising that in the three Pacific Coast states, over half of the people live in cities; yet these are among our youngest states. Even in the five great agricultural states of the east north-central group (Ohio, Ind., Ill., Mich. and Wis.) the city population already exceeds the rural. Yet in the east south-central group (Ky., Tenn., Ala., and Miss.) only 19 per cent of the people live in cities.

R. H. W.

THE COTTONSEED INDUSTRY

In twenty-five years the value of American cottonseed products has risen from \$20,000,000 to \$136,000,000, and many people in the cotton districts can remember when the cotton seed accumulated in huge piles about the ginneries, just as sawdust does near the sawmills; and it was just as worthless as the sawdust. Today the cotton fields of the United States have to a large extent replaced in the American economic system the olive groves of the Mediterranean district. The oil is a first-class edible product and the cake left after crushing the seed constitutes an equally valuable cattle feed.

THREE-FOURTHS OF THE WORLD'S COAL IN THE POSSESSION OF THE ENGLISH-SPEAKING PEOPLES

The United States contains one-half of all the known coal of the world. The entire British Empire contains one-half of the remainder, and all of the rest of the world the other half. It has often been said that China contains more coal than any other country, but the investigations made for the International Geological Congress seem to show that China's reserves are smaller than had been reported. It is not a fabric of the imagination that causes men to predict that the nations which control the coal of the world hold the key to the future. It is a matter of tremendous significance that the United States holds half the world's coal and that the English speaking people hold three times as much as the rest of the world.

THE SUN

1. It is 92,500,000 miles from the earth. This means that an express train traveling 50 miles an hour, or 1200 miles a day, or 438,000 miles a year, would require over 200 years to reach the sun.

2. The earth is about 3,000,000 miles nearer the sun in perihelion than in aphelion, and receives about 7 per cent more heat at that time.

3. The earth is nearest the sun in our winter, but the northern hemisphere then being tipped away from the sun, receives the sun's rays—or waves—least effectively.

4. The sun is of enormous size; 865,000 miles in diameter and possessing more than 300,000 times as much matter as the earth. If the sun were a hallow sphere of its present size and the earth were placed at the center, the moon could revolve about the earth in its regular orbit entirely within the sun, and have a wide margin to spare. Such a hallow sphere would hold more than a million balls the size of the earth. Of all the material which makes up the solar system—the sun, 8 planets, 800 asteroids, 26 moons, besides comets, and meteors—the sun alone contains 99.8 per cent.*

5. Neptune, the most distant of the sun's family of eight planets, requires 165 of our years to complete one revolution around the sun.

6. The temperature of the sun is computed to be about 6,000 degrees centigrade or twice as hot as the electric arc. It sends to the earth annually enough heat to melt a shell of ice 105 feet thick enclosing the entire earth; yet the earth receives only a two-billionth of the heat emitted from the sun.

7. The sun is not a burning body in the sense that coal or oil or gas burn. It is believed to be entirely gaseous. It is known to contain iron, gold, hydrogen—in fact, at least 40 of the same elements which make up the earth; yet all of the elements are vaporized by the intense heat. But, despite this gaseous condition, the enormous size of the sun makes the pressure upon the inner portions such that the entire body of the sun is 1.4 times as heavy as water. (The earth's density is $5\frac{1}{2}$ times that of water).

8. The source of the sun's heat is not satisfactorily explained. The theory that the heat is kept up through an incessant raining of asteroids or meteors upon the sun has been largely abandoned. Contraction has been offered as an explanation, but this could supply the heat for not over 15 million years, and this is wholly inadequate. The explanation is now being sought in the field of the radio-active elements, such as radium and helium, and the sun is known to contain an abundance of the latter.

9. The so-called "sun-spots" are of great size. The earth could be dropped into the larger ones. "They appear to be whirls of material coming outward from the inner layers of the sun toward the surface, spreading out like a waterspout." Sun spots appear in greatest numbers in periods 11 years

*See excellent article by Director W. W. Campbell on "The Evolution of the Stars and the Formation of the Earth," in *The Popular Science Monthly*, Sept., 1915, Vol. 87, p. 209.

apart and at these times they exert a pronounced effect upon the magnetic condition of the earth.

10. The sun rotates upon an axis, but, strangely, the equatorial portion of the sun's surface rotates nearly one third faster than portions at 75° latitude, showing that it is not a rigid body.

11. The radiations, or waves, which emanate from the sun, while carrying "potential" heat and light, do not either heat or illumine the space which they traverse; this space is both dark and cold despite the fact that it is filled with the sun's radiations. Only when these radiations strike material objects is light and heat, as such, developed.

R. H. W.

SOME PERSISTENT ERRORS IN GEOGRAPHY

MANY people apply the term *Rocky Mountains* to the entire mountainous region of the western United States. The Rocky Mountains are only the eastern ranges of this system and in Colorado are a thousand miles from the Pacific Coast.

Some maps and many of the older geographies refer to the Gulf Stream as washing the shores of Europe. The Gulf Stream frays out and wholly loses its stream-like character before it has passed half way across the Atlantic. Its waters mingle with those of the ocean and become a part of the great North Atlantic Drift which is driven slowly toward the coast of western Europe by the prevailing south-west winds. It is true, however, that western Europe derives a great deal of heat from the winds which blow over this warmed body of water.

It is frequently stated that the frigid zones have six months' day and six months' night. Only two points on the earth actually have six months' day and six months' night, the poles themselves. The longest day or night at the polar circles is only 24 hours. But the exceedingly prolonged dawn and twilight of the frigid zones give these regions a condition almost like daylight even when the sun is not above the horizon.

The impression is often given that the great harbors of the world are by nature suited to the needs of commerce. Millions of dollars have been spent and must continue to be spent to make and keep even excellent harbors suitable for modern commerce.

A quarter of a century after Syracuse, N. Y., had ceased to be an important salt-producing center, text books and some teachers were still describing it as "noted for its great production of salt."

Brazil no longer produces diamonds enough to be worthy of mention. Yet its reputation as a diamond field will probably continue a generation longer.

Pennsylvania mines are now producing almost no iron ore and have not for twenty years, yet this is news to a great many well-posted teachers.

RECENT PUBLICATIONS

AN INTRODUCTION TO SCIENCE. By Bertha M. Clark. 494 pp. American Book Company. 1915.

In her preface, the author says: "The aim of this book is to start young high school pupils on scientific projects which will influence for good their *present* lives." The book is highly practical. It deals with menus, the use of paints and varnishes, selection of fuels, school and home lighting, labor saving devices, the use of chemical agents to transform grease and sewage into useful products, such as soap and fertilizers, the application of hygienic facts and theories to sanitation, cooking, and many kindred topics. It is, in fact, a manual of elementary applied science, with only enough theory to explain the main principles involved. The last eight chapters deal with subjects usually treated in physical geography. The success of the author's earlier book, her experience as a teacher, and the thoroughly practical type of knowledge in this book all seem to combine in promising it a cordial reception.

COMMERCIAL GEOGRAPHY. By Alex. L. Curr. An Intermediate Text-book. A. & C. Black, London. 1915. 440 pp., 150 figures. \$1.10.

The book has much to commend it and one rather serious weakness. The latter is the frequency of errors. On page 275 we are told that half of the sugar beet crop of the United States is produced in Utah, while, as a matter of fact, scarcely one-ninth is produced there. Colorado, which produces three times as many sugar beets as Utah is not mentioned. On page 277 we are told that cheese comes mainly from the western states. For decades New York was the leading producer of cheese and is still second. That a source of petroleum, "described as one of the largest in the world," is in British Columbia, will surprise many. It must be admitted, however, that no one can write a commercial geography which does not contain a sprinkling of errors.

The book is well illustrated with sketch maps and diagrams but contains no colored maps. Important words are printed in black-face type. Questions follow the chapters; the causal idea is emphasized and statistics are reduced to a minimum.

SOUTH AMERICA: A GEOGRAPHY READER. By Isaiah Bowman; pp. XXII+354. Rand, McNally and Co., Chicago, 1915. 75 cents.

This is the second volume in the *Lands and Peoples Series*. The first volume is Ellsworth Huntington's "Asia." The series is under the editorial direction of Professor R. E. Dodge of the Teachers' College, Columbia University. The book is authoritative, thoroughly interesting in subject matter, and delightfully written. Professor Bowman has spent several years in exploration in South America and has seen many of the regions which he describes; this gives his descriptions that realistic quality which comes only from first-hand knowledge. There are upwards of 150 half tone illustrations, numerous sketch maps and drawings, and 12 colored maps. Some of the half tones are excellent; others fail in clearness of detail owing perhaps to

character of the paper upon which they are printed. Human geography receives the emphasis, as it should, particularly in a reader for children. There is no "writing down" and as a consequence the book is quite as interesting to adults as to children. Occasionally the phraseology seems a little too old for grade pupils, yet this is infrequent. The subject matter is so interesting and the way of presenting it is so pleasing that pupils who read it are sure to be carried along as by a good story. We cannot help wondering if it would not be better if we made our text books in geography upon similar models. Such a book as this is no inconsiderable contribution to the geography of South America.

EARLY ECONOMIC CONDITIONS AND THE DEVELOPMENT OF AGRICULTURE IN MINNESOTA. By Edward Van Dyke Robinson. Bulletin of the Univ. of Minnesota, Studies in the Social Sciences, No. 3, Minneapolis, 1915, 306 pp. 221 maps and diagrams.

Under the title "Early Economic Conditions and the Development of Agriculture in Minnesota," Dr. E. V. Robinson describes the economic history of a typical western state. Minnesota contains open prairie, hardwood forest and coniferous forest, and shows quite a wide variety in both soil and climate. Situated on the border of the semi-arid belt the state has perhaps been more subject to crop failures than have those to the east but on the whole is typical of the upper Mississippi Valley. These features are described in some detail in the first chapter.

In the time when fur-trading was the dominant industry, local agriculture was unable to supply the population. General agriculture was then favored by high prices. By 1850 fur-trading was giving place to lumbering but with other conditions substantially unchanged. But by 1860 an economic revolution had been accomplished. Settlement increased rapidly and wheat soon became the dominant crop. From 1860 to 1880 wheat held full sway. But the rapidity of the opening of new lands combined with the fall of prices following the Civil War, resulted in a prolonged period of agricultural depression. Crop failures and exhaustion of the soil also played their part in the next revolution from wheat-growing to dairying, a change still in progress. As the result of the use of machinery, experience has shown that farms should be larger than formerly, a process which has reduced the country population in large parts of Minnesota. The smaller families of modern times are believed to be in part due to the effect of machinery, as less labor is now required. However, the coniferous region still awaits settlement.

The report is profusely illustrated with dot maps, charts and graphical diagrams, often scattered in a confusing way through the text. While usually of excellent character, many of these are poorly drawn and lettered. There is no index.

F. T. Thwaites.

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THE CULTURAL AND THE TRAINING VALUE OF GEOGRAPHY*

By Bertha Henderson

University High School, University of Chicago

ACCORDING to the New Century Dictionary, the word "Culture" means refinement, purity in thought, love of the beautiful, wisdom, training and refining the moral and intellectual nature.

In our efforts to put geography on a scientific basis we frequently overlook its cultural possibilities. A great help toward bringing out this side of the subject is its relation to daily events, to the subjects which engage the attention in the best newspapers and periodicals. While we were studying Cotton in the commercial geography class an article appeared in the *Review of Reviews* dealing with the cotton situation brought about by the conditions in Europe. A number of my class came with information gained by reading the article. As a rule, adolescents are not attracted to that class of magazines nor to that type of articles. At another time we were opportunely studying the cattle industry when the epidemic of foot-and-mouth disease swept over the country. Some of our dignified seniors nearly tumbled over themselves coming into the geography room to tell of the reports in the newspapers. Perhaps if they had not been studying Commercial Geography, they would have at least read the headlines, but the point I am trying to make is that the interest is greatly augmented by the more intimate association with the subject in the class room.

CREATES AN INTEREST IN GOOD BOOKS

In the same way the study of geography directs the way toward a look into the world of books of travel and description. After a careful study of Panama and the Canal, books on that subject are more likely to attract the attention; and if we have given Russia her fair share of time in the study of regional geography, some of the newer, juster books describing that country have a better chance of being selected from the library shelves. Especially is this true if a taste of the book has been given in finding information for use in the class room.

STIMULATES A DESIRE TO TRAVEL

Regional geography stimulates a desire for travel, while physiography and commercial geography make interested and intelligent travelers. I well remember my journey into the Bavarian Alps in company with a large party

*Read before the Conference of Affiliated Schools at the University in April, 1915.

of Americans, most of them teachers, and many of them claiming educational titles. Some of us had studied geography and we had not eyes enough to see, nor mind enough to interpret all the wonderful stories in craig and peak, mountain wall and plunging stream, that were spread out before us during an entire day's travel. With the rest of the party, about three quarters of an hour of this scenery (for it was nothing more to them) satisfied them and they spent the rest of the day playing cards, reading novels, and gossiping. Yet they were people who were cultured, they told me so themselves, and said they had come abroad to add to their culture by studying the beautiful things in the old world. For them beauty existed only on canvas in an art gallery, or in picturesque situations in a dirty, miserable part of a city. Much of the beauty in the world depends upon our ability to see it and to interpret it; a knowledge of physiography lends greatly to this ability.

DEVELOPS SOCIAL INTERESTS

In a recent address, Rabbi Hirsch said, "Wisdom is knowledge hitched to humanity." Of all phases of geography perhaps commercial geography has the best hitching facilities. Through it we can easily arouse an interest in the social phase of commercial products. When the great importance of such commodities as wheat, iron, or coal is clearly understood it is not hard to stimulate the thought that the producers of this wealth are worthy of consideration; that the health, intelligence, and general comfort of the laborers are important factors in the equation of production; that conservation of exhaustible resources is a question of world wide importance.

TEACHES THE LIBRARY HABIT

One of the most potent helps in cultural development through geography is the opportunity it gives for the use of the library in regular daily work. Our subject is not static, but is concerned with the changing, growing, oscillating conditions of our surroundings. In many cases a textbook is behind the times as soon as it comes from the press. To my mind the advantages of the use of reference books over the use of one textbook are manifold. In the first place it gives a broader view of the subject matter. Each author who writes a book has, or thinks he has some new material to add, some new point of view, or some new or different method of treatment. Surely the reading of a number of different authors on the same subject, culling the contribution of each, is more profitable than reading several times over the material of one author. It is a rule of psychology that the mind reaches out for information about things of which it knows something but not everything. At about the third reading of the same page the mind begins to wander into more enticing fields, the effort to hold it to the task becomes drudgery, and the pleasure in acquiring knowledge is replaced by a feeling of repugnance. On the other hand if each reading is a new treatment of the same subject, the presentation from another point of view, enough fresh

material is given to hold the attention and to whet the appetite for more. Getting the lesson under these conditions at least has the advantage of variety over monotony.

GIVES AN ACQUAINTANCE WITH SOURCE MATERIAL

At the same time, as a side line, an acquaintance is acquired with the literature of the subject, and with the knowledge that work of this kind is important enough to have engaged the attention of writers, students, and publishers. The students make friends with a few of these books, know what they contain and where they are to be found. As they read they must learn to weigh and judge the worth of each author, must get beyond the notion that a statement is true because it is published. If there are contradictory or differing statements they may be stimulated to go to sources and find the truth for themselves, which is a long step toward scholarship. They may grow into a breadth of vision and tolerance that will at least admit that there is more than one side to a question, and that one writer may be just as honest, just as sincere, and just as wise, when he holds to a certain view of the matter in hand as the one who takes the other side.

REPLACES TEXTBOOK DRUDGERY

Most textbooks are dry, prosy reading. In their very nature they are concerned with the clearest statements in the fewest possible words. Their mission is not to attract the reader but to teach him. One of our great educational philosophers said, "Man should be taught as if you taught him not." This principle can not be applied to the textbook. In high school geography we are not alone concerned with filling the mind with facts. Most of the facts we teach are soon forgotten and it is well that they are. In addition to the facts, we wish to throw a geographical atmosphere around the student, pleasant, agreeable, satisfying enough to make him want to keep it after school days are over. One of the helpful means to this end is the ability to read with pleasure, or for recreation, books or magazine articles of travel and description. Many of them are charmingly written, contain valuable information, and hold the interest. Searching for knowledge in them is a pleasure and not drudgery. Hedge a deep, wide-reaching subject within the narrow confines of a textbook and you have reduced it to bare outlines devoid of enlivening relations, almost to a dead skeleton. Teach the same subject from as many books as possible, with field work, museum material, etc., and the very nature of a geographical topic will be vibrating with life, its radiating lines will run out into many allied subjects, and will awaken interests that lead to wider outlooks and richer lives.

TRAINS IN THE USE OF INDEXES AND BIBLIOGRAPHIES

Another great advantage is training in the use of the library and books. In order to find the material wanted the use of the index and table of contents must become a habit. After a few bibliographies have been given out

on an assigned topic, the students may be given the task of making their own bibliographies. I usually begin this by putting on the reserve shelf the books bearing on the subject, and then sending the class to list the books—with author, titles, pages, etc.,—that contain material. Usually I ask that the paragraphs, headings, and their pages be listed with the books. Not long ago I sent a class to the library to make a bibliography on *Coal* and one boy came back with a list of 25 books all nicely classified and divided into subheads. One or two assignments where the books are all gathered and put upon the reserve shelf is enough. After that only the standard books are kept on the shelf, and the students are sent to the card catalogue, Reader's Guide, and Pool's Index to supplement the reserve books. They are also encouraged to go to the college library, the Crerar, or any other available one for books on the same subject. After the first plunge this is great fun. The knowledge of how to use the library is one of the most valuable assets that may be given to the pupils of the high school. I have sometimes wondered if the great slaughter of the freshmen at the end of the first semester in college might not in a small way, be due to the fact that the freshman does not know how to use sources of information. He may be possessed of mental power enough to do the work, yet not know how to go about it. If he knows how to use the library and is accustomed to working in it and making it serve him, some time is surely saved for him.

LIBRARY WORK NOT NECESSARILY DESULTORY

The objection may come that some of the essential points of a subject are missed in the scattered study in the library. In this wider method of study each reader fixes upon the points that are essential to him, and surely he is the best judge. Under the wise direction of the teacher the attention will be directed to the essential things and each student will grasp that which appeals to him. We have no right to force our judgment upon the class to the exclusion of the individual bias of the students, and adolescents are very temperamental. The phase of a subject that will appeal to one may have but little interest for another. In one set of papers, 21 in number, handed to me on *Cotton* there were seven different treatments of the subject and each one was good. Yet the 21 had all studied the same books and attended the same recitations. Again, the cry is raised that the high schools have no libraries. When Kitchener was made war lord last year he went to the war office, and as he entered he said to the guard at the door, "Is there a sleeping cot in this building?" "I do not know, sir," said the guide. "Get one," said Kitchener, and passed on into the building. They put in the cot. When the teachers want libraries in the high schools and make their wants known in no uncertain manner the libraries will be put in just as the laboratories were.

CONCLUSION

To sum up: Through the study of geography we may direct the student to current periodicals and newspapers of a good class, we may stimulate

them to read books of travel and description, and arouse a desire to travel, and at the same time we may train them into library habits. We may lead them to respect labor, to appreciate beauty in nature, and to an ethical point of view in the social phase of the study of the great commercial products.

WHERE OUR PRINCIPAL MINERALS COME FROM

By F. E. Williams

University of Wisconsin, Madison

THE following statistics, given in round numbers only, are taken from Mineral Resources of the United States for 1913 (published by the U. S. Geological Survey). More detailed information and statistics of the less common minerals may be obtained by consulting the above publication. Unless otherwise stated the figures given are for the year 1913. Only the more important producers of the different minerals are listed.

Aluminum.—Aluminum may be obtained from several different minerals but most of the product of the United States is derived from bauxite which is a mineral resulting from the decay of a granite-like rock called syenite.

Production: U. S. 210,000 long tons valued at.....\$997,000
France (in 1911) 251,000 long tons.

Gold.—Over 91 per cent of the gold was produced from silicious ores (gold-quartz and gold-silver quartzose ores) and placers (gravel beds). Most of the remainder came from the copper, lead, and zinc mines.

Production: United States	\$ 89,000,000
California	20,240,000
Colorado	18,110,000
Alaska	15,200,000
Nevada	11,977,000
South Dakota	7,214,000
Africa (1912)—mostly South Africa.....	212,000,000
Australasia (1912)	55,000,000
Mexico (1912)	25,000,000
Russia and Finland (1912)	22,000,000

Silver.—Silver is produced largely from the same kind of ores as gold but less than 1 per cent is obtained from placers while a large per cent (between 55 and 60 per cent) is obtained from the ores of copper, lead, and zinc.

Production: United States	\$ 40,350,000
Nevada	9,457,000
Montana	7,574,000
Utah	6,814,000
Idaho	5,724,000
Colorado	5,429,000

Mexico (1912)	47,600,000
Canada (1912)	19,425,000
Australasia (1912)	9,700,000
Germany (1912)	8,160,000
Peru (1912)	5,380,000

Iron.—Iron, for the most part, is obtained from some oxide of the metal and the reddish ore known as hematite furnishes a large portion of the product.

Production: United States, 62,000,000 long tons.....	\$131,000,000
Minnesota, 38,600,000 long tons, 62.37% of U. S.....	80,790,000
Michigan, 12,840,000 long tons, 20.72% of U. S.....	33,480,000
Alabama, 5,200,000 long tons, 8.42% of U. S.....	6,649,000
New York, 1,460,000 long tons, 2.36% of U. S.....	3,100,000
Wisconsin, 1,020,000 long tons, 1.64% of U. S.....	2,150,000

Districts—

Lake Superior, 52,377,000 long tons, 84.51% of U. S.
Birmingham, 4,602,000 long tons.
Adirondack, 1,215,000 long tons.
Chattanooga, 709,000 long tons.

Iron ore is often smelted at some distance from the mines as shown by the following figures for pig iron:

United States	31,000,000 long tons
Pennsylvania	12,900,000 long tons
Ohio	7,100,000 long tons
Illinois	2,930,000 long tons
New York	2,065,000 long tons
Alabama	2,057,000 long tons

Foreign Ore Production—

Germany and Luxemburg (1911)	30,000,000 long tons
France (1911)	16,300,000 long tons
United Kingdom (1911)	15,500,000 long tons
Spain (1911)	9,000,000 long tons

Copper.—Copper-bearing minerals are numerous and widely distributed but the number of important producing districts is comparatively small. The ores of copper are numerous but there are only a few that are important.

Production: United States....\$189,795,000.....1,224,500,000 lbs.

Arizona	404,279,000 lbs.
Montana	285,720,000 lbs.
Michigan	155,715,000 lbs.
Utah	148,057,000 lbs.
Nevada	85,210,000 lbs.
Japan	161,377,000 lbs.

Spain and Portugal*.....	120,592,000 lbs.
Mexico (162,479,000 lbs. in 1912).....	116,403,000 lbs.
Australia	104,278,000 lbs.
Chile	88,184,000 lbs.
Canada	76,976,000 lbs.
Russia	74,736,000 lbs.
Peru	56,658,000 lbs.
Germany	55,776,000 lbs.

Lead.—Lead and zinc are frequently associated in a great variety of ores and found under many different conditions as in veins, irregular masses in rocks, or in residual clays.

Production: United States, 32.4% of total.....	412,000 short tons
Missouri	176,000 short tons
Idaho	158,000 short tons
Utah	83,000 short tons
Colorado	44,000 short tons
Spain	224,000 short tons
Germany	200,000 short tons
Australia	128,000 short tons
Mexico	68,000 short tons
Belgium	56,000 short tons

Zinc—

Production: United States	418,000 short tons
Missouri	124,000 short tons
New Jersey	84,000 short tons
Colorado	59,000 short tons
Montana	44,000 short tons
Wisconsin	30,000 short tons
Germany	312,000 short tons
Belgium	217,000 short tons
France and Spain	78,000 short tons
Great Britain	65,000 short tons

Nickel.—The United States refines more nickel than any other country but practically all of it comes from Canada with a small amount from New Caledonia (a group of islands east of Australia). The Canadian production in 1913 was valued at over \$7,000,000.

Platinum.—Very little platinum is produced in the United States. A small amount is obtained in California and Oregon. Platinum was (1913) worth about \$45.00 per troy ounce in New York City.

Foreign Production—

Russia	250,000 troy oz. (over 93% of total)
Colombia	15,000 troy oz.

Tin.—Tin is one of the few metals which are relatively abundant in some localities of the world which are not abundant in the United States. The Straits Settlements produce by far the greatest quantity of tin nearly all of which comes from alluvial deposits. In 1913 shipments amounted to 56,142 short tons (worth 37 to 50c per lb. in New York City). Bolivia is a large producer, nearly all of which comes from lodes or veins.

Asbestos.—Asbestos is a fiber-like mineral mined mostly in ancient crystalline rocks. The province of Quebec, Canada, is the largest producer of raw material and the United States is the largest producer of manufactured asbestos products.

Production:

Canada (1912)	136,000 short tons (about 85% of total)
Russia (1912)	18,000 short tons
United States (1912)	4,000 short tons (less in 1913)

Canadian asbestos ranged in price (1912 and 1913) from \$10 to \$350 per short ton depending on kind, length of fiber, and freedom from impurities.

Asphalt.—Natural asphalt is obtained largely from some kind of bitumen found in veins or lake-like bodies. Bituminous rock is also an important source.

Production—

United States, 93,000 short tons.....	\$751,000
Utah, 31,000 short tons.....	529,000
California, 28,000 short tons.....	70,000
Kentucky, 17,000 short tons.....	60,000
Oklahoma, 16,000 short tons.....	91,000
Trinidad, 230,000 short tons.....	633,000
Venezuela, 84,000 short tons.....	400,000
France (1910) 187,000 short tons.....	277,000
Italy (1912) 182,000 short tons.....	581,000
Germany (1911) 90,000 short tons.....	155,000
Austria-Hungary (1910) 9,000 short tons.....	702,000
Spain (1910) 7,000 short tons.....	18,000

Manufactured or oil asphalt was produced in the United States (1913) to the amount of 437,000 short tons valued at \$4,532,000.

Portland Cement.—Practically all of the cement produced in this country is Portland cement which is made by burning a finely ground mixture of lime, silica, alumina, and some iron oxide.

Production—

United States, 92,000,000 bbls.....	\$93,000,000
Pennsylvania, 29,000,000 bbls.	
Indiana, 11,000,000 bbls.	
California, 6,000,000 bbls.	

New York, 5,000,000 bbls.

Illinois, 5,000,000 bbls.

Missouri, 4,800,000 bbls.

Coal.—The two important varieties of coal are bituminous, or soft coal, and anthracite, or hard coal. Bituminous coal is found in many states but anthracite is restricted to but few localities. The United States produced 39.49% of the world's total.

Production—

United States (bituminous) 479,000,000 short tons.....	\$565,000,000
Pennsylvania, 174,000,000 short tons.....	193,000,000
West Virginia, 72,000,000 short tons.....	73,000,000
Illinois, 62,000,000 short tons.....	70,000,000
Ohio, 36,000,000 short tons.....	40,000,000
Kentucky, 20,000,000 short tons.....	21,000,000
Pennsylvania (anthracite) 92,000,000 short tons....	195,000,000

Foreign Coal Production—

Great Britain, 322,000,000 short tons.

Germany (1912), 282,000,000 short tons.

Austria-Hungary (1912), 58,000,000 short tons.

France (1913), 45,000,000 short tons.

Russia (1912), 32,000,000 short tons.

Belgium (1912), 25,000,000 short tons.

Japan (1912), 22,000,000 short tons.

Petroleum.—The United States produced 65.12% of the world's product of petroleum.

Production—

United States, 248,000,000 bbls.....	\$237,000,000
California, 98,000,000 bbls.	
Oklahoma, 64,000,000 bbls.	
Illinois, 24,000,000 bbls.	
Texas, 15,000,000 bbls.	
Louisiana, 12,000,000 bbls.	
Russia, 61,000,000 bbls.	
Mexico, 26,000,000 bbls.	
Roumania, 13,500,000 bbls.	
Dutch East Indies, 12,000,000 bbls.	
Galicia (N. E. Austria-Hungary), 7,800,000 bbls.	

Natural Gas.—The United States is by far the greatest producer and user of natural gas.

Production—

United States, 581,900,000,000 cu. ft. (estimated).....	\$88,000,000
West Virginia	34,000,000

Pennsylvania	22,000,000
Ohio	10,000,000
Oklahoma	7,000,000
Kansas	3,000,000
Canada, 20,345,000,000 cu. ft. (estimated)	3,000,000
Hungary	Small amount
Italy (1912)	57,000
United Kingdom	Very small amount

Granite—

Production—

United States	\$21,000,000
Vermont	3,800,000
Massachusetts	2,100,000
Maine	1,800,000
New Hampshire	1,500,000
California	1,450,000

Graphite.—Graphite is found in either igneous, sedimentary or metamorphic rocks. The deposits of greatest commercial importance are veinlike which may traverse one or all of the above group of rocks. It is used in the manufacture of crucibles and other refractory products, for lubricating, for pencils, for graphite paint, and for coating molds in foundries.

Production of natural graphite—

United States (1913) 4,775 short tons	\$294,000
Austria (1911) 47,000 short tons	332,000
Ceylon (1911) 30,000 short tons	2,160,000
Italy (1911) 14,000 short tons	75,000
Germany (1911) 12,500 short tons	73,000

Practically all of the natural graphite produced in the United States was mined in Alabama, New York, and Pennsylvania.

Phosphate Rock.—Among the fertilizers used, phosphate of lime plays an important part. Southeastern United States mines most of this country's product.

Production—

United States, 3,100,000 long tons	\$11,800,000
Florida, 2,540,000 long tons.	
Tennessee, 452,000 long tons.	
South Carolina, 109,000 long tons.	
Tunis (1911) 1,590,000 metric tons.	
Algeria (1911) 739,000 metric tons.	
France (1911) 312,000 metric tons.	
Belgium (1911) 197,000 metric tons.	

Salt.—Salt is produced in various ways for it occurs naturally in two distinct forms—(1) rock salt in beds, and (2) in natural brines or bitterns. Some of the salt is mined and some produced by evaporation of brine. The processes used at the present time are: (1) Solar evaporation; (2) direct heat evaporation in open kettles or open pans; (3) steam evaporation in jacketed kettles; (4) vacuum pan evaporation.

Production—

United States, 34,400,000 bbls.....	\$10,125,000
Michigan, 11,530,000 bbls.	
New York, 10,780,000 bbls.	
Ohio, 5,310,000 bbls.	
Kansas, 2,700,000 bbls.	
California, 1,082,000 bbls.	

In Michigan and Kansas the salt is obtained both by mining rock salt and evaporating brines; in New York and Ohio largely by evaporation of brines from deep wells; in California by solar evaporation of sea water.

Sulphur.—The United States and Italy produce about the same amount of sulphur although in 1913 Italy marketed more than the United States. In Italy, which was until quite recently the most important source, the sulphur is mined. The same is true for Wyoming and others of our western states. In Louisiana and Texas, where most of the sulphur of this country is obtained, the solid material is melted underground by superheated water and the liquid is pumped or forced to the surface.

Production—

United States, 311,590 long tons (marketed)	\$5,480,000
Louisiana, Texas, and Wyoming were the leading states, with the first named far in the lead.	
Italy, 346,213 long tons (mined).	

FOUR HUNDRED MILLION FROM THE COMSTOCK

The famous Comstock lode of Nevada is a great fissure vein, 4 miles long, along a line of faulting in the eruptive rocks of the Virginia Range. It crops out on the east side of Mount Davidson. The ore, which is of high grade, carries silver and gold in quartz. In the old days it occurred typically in great bodies called "bonanzas." The district was noted for the large scale on which everything connected with the mining, including the speculation, was carried on. The size of the old dumps and the kind of machinery employed show that great things were done here. About \$400,000,000 in gold and silver, in the ratio, by value, of 2 of gold to 3 of silver, has been taken out of the Comstock. Considerable ore is still being mined, but the great bonanzas have all been worked out.

THE CARNEGIE INSTITUTION'S ATLAS OF THE HISTORICAL GEOGRAPHY OF THE UNITED STATES

By Charles O. Paullin

Department of Historical Research, Carnegie Institution of Washington

THE Department of Historical Research in the Carnegie Institution of Washington is preparing for publication an *Atlas of the Historical Geography of the United States*, which will be of interest to geographers as well as historians. Since the proposed work covers a field common to history and geography, specialists in each of these branches of knowledge are co-operating in its production. Several distinguished scholars have already given it the benefit of their services—among historians, Prof. Jesse S. Reeves of the University of Michigan; Prof. Max Farrand of Yale University; Prof. O. G. Libby of the University of North Dakota, and Prof. Frank H. Hodder of the University of Kansas; and among geographers, Prof. R. H. Whitbeck of the University of Wisconsin; Mr. James White, assistant chairman of the Canadian Conservation Commission; Mr. John E. McGrath of the U. S. Coast and Geodetic Survey, and Dr. Otto Tittman, formerly superintendent of that survey.

The completed Atlas, exclusive of text, will contain some two hundred pages (or double plates) measuring about twenty-eight by eighteen inches. A few of the maps will be approximately the size of the double plate, some one-half or one-fourth that size, and many of still smaller sizes. When possible the maps will be constructed in series, each covering a considerable period of time. This will permit the making of comparisons between the several maps of any one series, as well as between maps of different series, both of which comparisons those who use or interpret the maps will wish to make. With a few exceptions, such as the maps showing geological strata or the ancient ice sheet, the period of time covered by the Atlas is that beginning with the discovery of America in 1492 and ending with the date of publication, a few years hence. The area covered will be generally a whole or a part of the continental United States, but occasionally it will be necessary to represent our detached possessions, the adjacent parts of Canada and Mexico, and the North Atlantic and North Pacific oceans.

The kinds of information to be illustrated may be briefly described as such historical information as admits of cartographical treatment and such geographical information as is of primary interest to historical writers and teachers. A notion of the contents of the Atlas may be obtained from the following general headings of its several divisions, which have been proposed: physical geography, aborigines, early maps of America, routes of explorers and colonizers, boundaries and divisions, industrial and social maps, political maps, city maps, and military maps. Possibly of most interest to geographers will be the physical and the industrial and social maps. Of the former, the Atlas will contain maps illustrating the relief, soils, rainfall, climate, and

geology of the United States, and maps showing the ancient ice sheet and the currents and winds of the North Atlantic and North Pacific oceans. The following maps showing industries and resources are now in manuscript and are ready for publication; manufacturing centres, 1839, 1859, 1879, 1909; iron manufactures, 1857, 1879, 1909; cotton manufactures, 1810, 1839, 1879, 1914; distilleries and distilled spirits, 1809, 1909; natural forest regions; coal fields, 1913; petroleum fields, 1914; distribution and production of iron ore, 1913; copper, gold, and silver mining districts, 1912; railroads for each decade from 1840 to 1910, and the great consolidation of railroad systems; and maps showing abandoned canals and those still in use.

The political maps, which are to be constructed somewhat after the method followed by Prof. Frederick J. Turner of Harvard University, will correlate politics with geography, and will show the geographical distribution of political sentiment. For this division there have been completed thirty-two manuscript maps showing the distribution of votes (chiefly by counties) for the presidential elections from 1788 to 1912. There have also been completed a series of maps showing the distribution of votes in the lower house of Congress on thirty-one important national measures, beginning with the amendment for the Assumption of State Debts in 1790, and ending with the Underwood Tariff act of 1913. At the present time the preparation of a series of maps illustrating international boundary disputes is engaging the attention of the Department of Historical Research.

ALUMINUM THE MOST ABUNDANT METAL

Aluminum is the most abundant of all the metals. In the form of its oxide, alumina, it constitutes about 15 per cent of the earth's crust, according to the United States Geological Survey. Yet until recent years it was a curiosity; there were only a few hundred or few thousand pounds in existence, and its value was \$14 or \$15 a pound. Within a generation it has become very useful, now selling at about 20 cents a pound. The entry of aluminum into the field of useful metals came with the discovery that it could be extracted from the mineral bauxite, a claylike substance. This mineral itself is by no means plentiful, but known deposits are sufficient to make aluminum an important competitor of certain metals, such as copper and tin, in a good many lines.

Already aluminum has displaced steel in certain classes of construction where strength is required in combination with extreme lightness, such as in the manufacture of flying machines. An alloy known as duralumin, containing about 95 per cent of aluminum, is claimed to have qualities as good as those of good Bessemer steel, although it is only one-third as heavy. This alloy possesses great hardness when annealed, and its melting point is above 1200 degrees F. The great future of aluminum lies in the perfection of a process whereby it can be commercially extracted from the unlimited deposits of alumina-rich clays and rocks.—[*Commercial America*.]

TYPES OF LABORATORY EXERCISES FOR HIGH SCHOOL GEOGRAPHY

By Cassa C. Benham*
Hillsville, Va.

THE exercises in the manual have been written after a careful review of the needs of Geography as given in various articles published in the *Journal of Geography* and other papers since 1890. It was found that the demands for humanizing Geography have steadily increased, and that laboratory work in Geography can be made as interesting and profitable as that of Physiography. So with these two purposes in mind, together with a desire to increase interest in reading maps, and to create a deeper sympathy with man, these exercises have been written.

The manual includes twenty-one exercises most of which contain enough material for two or more laboratory periods. The whole course is intended to cover a year's work in High School Geography, but it is not expected that any class can accomplish all the work proposed. Choice is left to the teacher's discretion. If the course is limited to a half year, only a part of each exercise should be used. Other exercises might have been prepared but the choice was given to subjects whose illustration by maps or other means would require a medium expense.

A large number of maps have been suggested in the exercises. To procure all of these would make the cost high for the average laboratory. Many maps may be used in two or more exercises, for example, Rand and McNally's map of the United States may be used in ten of the exercises. If it is expected to clip the exercises, of-course only the maps that will be used need be purchased.

The laboratory equipment is for the ideal laboratory. The teacher with ingenuity might sometimes substitute maps already in the laboratory or those in reliable text books.

EXERCISE 1.

Material—

1. Columbus, Ohio. Columbus Quadrangle, U. S. G. S.
2. Cleveland, Ohio. Euclid, Berea, and Cleveland Quadrangles, or the Cleveland Special U. S. G. S., or Cleveland Harbor, Lake Survey, or both.
3. Denver, Col. Denver Quadrangle, U. S. G. S.
4. Pittsburg, Pa. New Kensington, Pittsburgh, Carnegie, Sewickley Quadrangles, U. S. G. S.
5. San Francisco, Cal. San Francisco, Coast and Geodetic Survey, No. 5530, (1911) or San Francisco and vicinity, U. S. G. S., or both.

*The work involved in preparing these studies was done as a part of the requirement in a course in The Teaching of Secondary School Geography, given at Oberlin College by Professor George D. Hubbard. The author's thanks are hereby expressed to him for suggestions and criticism in the course. The preface and three exercises are here selected; and a list of all exercises in the guide is added.

6. Omaha, Neb. Omaha and vicinity Quadrangle, U. S. G. S.
7. Chicago, Ill. Lake Survey Chart, Chicago Harbor, or U. S. G. S. Quadrangles, Calumet, Des Plaines, Riverside and Chicago or both.
8. Seattle, Wash. Seattle or Snohomish Sheets U. S. G. S. United States Coast and Geodetic Survey Chart, No. 6400—Seacoast and Interior Waters of Wash. (50c).
9. Birmingham, Ala. U. S. G. S. Birmingham, Bessemer Special, Leeds, Vandiver Quadrangles.
10. Minneapolis, Minn. St. Paul and Minneapolis, Quadrangles U. S. G. S.

A City—

(Suggestion: Choose the nearest or best known first, then use one other).

1. Observe the main streets of the city with respect to their length and direction. Where is the business section located? Where are the mills and factories located with reference to each other? to the business section? to the residence district? to the streams? to the railroads? Why are things so arranged? Observe the size of the water body or river upon which the city is located. Why is this special place an advantageous location? Of what use is the river to the city? Notice the culture along the streams, i. e., wharves, parks, bridges, etc. Why are they present? Determine the number of railroads. Can you state any reasons why this is their meeting place? Follow them singly out of the city. Where do they go? From whence do they come? Why do they take such routes with reference to direction? to rivers? to mountains? to plains? to lakes, etc.? Observe the number of side-tracks. What is their relation to certain factories? To transportation needs?

2. Contrast and compare other cities. Why are there such striking similarities or such dissimilarities?

EXERCISE VII. CANALS.

Material—

Picture of Panama Canal published by the National Geographic Society, Washington, D. C. Map showing the canal route. Map showing steamship routes. Recent population map of U. S., of Americas, or of world. Map of Suez—Mediterranean Eastern end, large scale, British Admiralty, London. Maps of the Welland Canal—Canadian Geological Survey. Irrigation Canals: for Truckee-Carson, Nev., use Truckee and Sierraville, Cal., Wabuska, and Wadsworth, Carson and Reno, Nev., sheets, U. S. G. S.

For Feather River, California region use Marysville, Smartsville, Bidwell Bar and Chico sheets U. S. G. S.

For the Okanogan region in northern Washington: Chopaka, Osoyoos, and Okanogan sheets U. S. G. S.

For Roosevelt Dam, Salt River, Arizona, use Roosevelt sheet, Arizona U. S. G. S.

For Caldwell-Middletown region in western Idaho use the Nampa and Boise sheets U. S. G. S.

1. *Canals for Transportation.*

Why is the Panama Canal necessary? What towns upon it? To what are they related? How has the canal probably affected their progress? How may it affect the commerce of the U. S.? Of all the world? What physical features have contributed to the location and kind of canal here? How does the climate affect the density of population in the canal zone? Is it possible that great industries will spring up in this zone? Why? Compare the Suez, the Welland, and the Kiel Canals as to their possibilities for power, and transportation.

2. *Canals for Irrigation.*

In a specific irrigated district notice the density of population as compared with that of a plain. What is the reason for this? What conditions might make dams and canals possible? What condition is here? How may power be obtained? Compare the Roosevelt dam project with that of the Feather River region of California. Show how they affect agriculture and horticulture? What two reasons make irrigation canals necessary here? What conditions make them possible? What might make an increase in the number of these projects in this region? How may they be developed?

EXERCISE XVII. AN AGRICULTURAL REGION.

Material—

A physical map as a basis for a small agricultural area. A group map of the states of Ohio, Indiana, Illinois, Iowa, Minnesota, and Wisconsin in a text book.

A Soil Types map from the U. S. Bureau of Soils, Washington, D. C.
As a type use any of the Prairie States.

From general knowledge what kind of a place physically—plain, plateau, mountain, etc.—is best adapted to agriculture? Of which character is the type state? How is it located with reference to mountains? What effects may mountains have on the agriculture of a region? What factors contribute in making a region good for agriculture? How is the prairie region drained? Into what do the streams empty? On a political map notice the cities and railroads. How many cities? How are they located with reference to one another? to rivers? to lakes? to railroads? to mountains? Why? What is their direct relation to the region as a whole? As commercial centers for exchange how are they related to cities of other regions? In what way are the cities of the agricultural region independent? How are they dependent upon the mountains? Upon the seacoast towns? Upon the ocean? How are agriculture and the climate related? Where rainfall is insufficient how does man attempt to meet the need? How are roads an adjustment in an agricultural region? What kinds are there? What plans do roads have? Are they a necessity to man? Why? From a crop map name the products of this region? Which are indirectly the result of agriculture? From a soil map learn the soil types suitable for agriculture.

2. Compare the Prairie States with the High Plains for agricultural advantages. With the Llano Estacado. Give reasons for similarities and differences.

LIST OF EXERCISES IN THE MANUAL

1. A city
2. A river as related to cities and industry
3. Man's use of a plain
4. Human adjustment to mountains
5. The culture of a plateau
6. Railroads
7. Canals
8. Economic importance of lakes
9. Coasts and harbors
10. Man and the ocean
11. Island peoples
12. Deltas and delta cities
13. Life in the desert
14. Glaciers as related to human occupations
15. Man's responses to temperature conditions
16. Rainfall and relief
17. An agricultural region
18. An industrial region
19. Forest and grazing
20. Scenic centers
21. Life and density of population

TEXTS FOR HOME GEOGRAPHY

DR. Charles A. McMurry, in his latest book, on *Conflicting Principles of Teaching*, emphasizes the need that teachers work out in detail the application of general pedagogical principles to the many topics and problems of geography and other studies. For the individual teacher the task is an interesting and fundamentally profitable one, though somewhat disheartening—it seems so endless. Just here the school printing press may be of great service, for the outlines and questions printed at one school may be interchanged with those prepared for class use elsewhere, when duplicated clearly and without cost. The *Journal of Geography* will gladly list those ready to exchange such detailed plans of class treatment of important topics, whether printed or duplicated in other ways.

In every community the topic most needing such full and thoughtful study of detail, with a view to their best presentation and development in class, is home geography. When the results of such studies, by the class of teachers who subscribe to this *Journal*, are put in printed form they will inspire to good work more teachers than those in the special towns and cities studied.

The Lynn Chamber of Commerce appreciates that it is best to base the future development of the city on a knowledge of its resources and history. The Chamber is arranging to have teachers and other citizens prepare brief texts on different phases of the history, geography, literature, and other life interests of the city; these to be printed by the school printing departments for use in all classes. This will be done practically without cost to either Chamber or City, for it represents the result of cooperation by many for the common good. The like may be done anywhere, and by exchange all may profit; and every new edition of a local text in each community will then represent a definite advance based upon experience in many places.

In geography there should be a text to accompany the first study of a town in the fourth grade. This may well be in the form of separate leaves. One will aid a teacher in making purposeful the enthusiasm for a first field trip to some hill or tower overlooking the town. By questions the leaflet will guide the children as to what to see and will set them thinking of the simple causes and relations. Another text leaf will follow the field lesson. This may be a reading lesson. It will name, perhaps define, the various land and water forms seen. This should tell enough of early pioneer life to make clear how plains, valleys and hills, streams, falls, and the like, affected the settlement, occupations, and movement of the settlers. This will lead to a statement of the broad effects of the town's physiography on the distribution of homes, industries, trade centers, and roadways today. Of course this text will follow good teaching and class discussion, and not precede them; though that would be far better than present omission of all such considerations in most communities. Similar pairs of leaflets will consider in more detail separate features of local geography—valleys, plains, lakes, life centers, industries, roads, etc.

A text for a higher grade, the eighth, should traverse the same ground in a more thorough fashion. It will then be timely to consider in some fulness the physiographic history of local land forms, so making clear their past influence on human life and their potential values for future development. This will serve also as a sound basis for general physiographic study by those who pursue the subject in the high school. In this grade also the development of local industries should be somewhat thoroughly studied,—the nature and processes of the industry from raw materials to finished products, more especially as these make clear geographical relations; also the history of its development in the community and the local and general geographical relations. These local studies will illuminate all world studies of industry. With each, an earlier leaflet will direct investigation, thought, and discussion; while later pages will put facts, relations, and conclusions in form for effective review. All other texts, presenting local legends and biography, pioneer life and its changes, relations of local history to that of colonial times and the national period, will serve to make the local geography of more interest and value if handled aright.

PHILIP EMERSON.

RIVERS

In their Influence upon Man and his Activities.

By W. R. McConnell

Normal School, Platteville, Wisconsin

1. Rivers are natural extensions of the sea into the land and are important agencies of transportation.

The price of transporting goods by water still averages less than one half the cost of any form of land transportation.

Ocean vessels go up the Amazon 2300 miles into the interior of Brazil.

The rivers of Russia are its chief highways of transportation. This country has 50,000 miles of navigated streams, but only 46,000 miles of railroads.

With only 6,000 miles of railroad, China's 400,000,000 people depend largely upon rivers and canal connections for the transportation of freight and people.

2. The surface of the land drained by a river system is modified by stream erosion into a series of valleys, slopes, and ridges, and may be ultimately reduced nearly to base-level as a result of such action. The distribution of the population and the human activities of a region are greatly influenced by the topography of the land.

3. Valleys formed by rivers during the process of wearing away the land exert a notable influence upon the activities of man.

The valleys of streams rising in highland areas in time become lowlands, extending back into the highlands, and are utilized for the construction of roads, railroads, and for agricultural purposes.

A sinking coast drowns the river mouths, and the bays that result from this form the world's best natural harbors. New York, San Francisco, London, Hamburg, and Bremen are examples.

If the valley has the form of a canyon or gorge the resulting natural scenery may add much to the pleasure of life.

4. Rivers, in degrading the land, carry away much material that makes for fertility of the soil.

The Mississippi carries daily into the Gulf of Mexico more than 1,000,000 tons of rich material; and it is removing material more slowly than other important rivers of the world.

The annual loss to the United States from the removal of soils by stream action is millions of dollars.

It is estimated that more than 3,000,000 acres of land in eastern United States has been ruined by erosion.

5. Rivers, particularly in their lower courses, often deposit a sediment over the lowlands bordering them, and in this way make alluvial plains of great fertility which are capable of supporting dense populations.

The Egypt of history is a narrow strip of land bordering the Nile River.

The density of population of the Ganges Valley in India is 389 per square mile, while the average for all India is 167 per square mile.

The flood plains of the rivers in southeastern China are the most densely settled large areas in the world.

Forty per cent of the people of Italy live in the Po valley.

In New England, the river valleys have had a steady increase in population and in the value of the land during the last half century, while the population of the uplands has had no notable increase and in many sections land values have declined.

6. In building deltas at their mouths, rivers have made much new and fertile land, as in the case of the Nile.

The delta of the Ganges and Bramaputra is about the size of the state of Illinois, and supports 500 people per square mile.

The "Imperial Valley" of California, so famous for fruit, is a delta built up by the Colorado River at the head of the Gulf of California.

7. Many river waters contain fish which form an important source of food supply. The salmon industry is centered around the Pacific rivers of northwestern North America.

8. Rivers with rapids and falls are an important source of power.

Manufacturing in New England grew up at water power sites.

The falls where the Atlantic rivers leave the Piedmont plateau have been an important factor in locating the so-called "Fall Line" cities.

Maine does two-thirds of its manufacturing by water power.

Switzerland does much of its manufacturing by water power supplied by swift mountain streams.

9. In arid and semi-arid regions rivers furnish water for irrigation. The people of some river valleys, as the Nile and Indus, depend upon the waters of the rivers for their entire water supply. 45,000,000 acres of land in our arid west are thought to be irrigable by the water from streams that have their sources in the mountains.

GREAT PREHISTORIC LAKE

Lake Agassiz was a body of fresh water that existed during a late stage of the glacial epoch in the valley of the Red River of the North and extended northward from the present head of that stream for nearly 700 miles. Its area at the time of its greatest expansion was about 110,000 square miles, exceeding the present aggregate area of the five great lakes tributary to the St. Lawrence.

The shore of this ancient lake is marked by well-defined beaches, and it is from these that the existence and the extent of the lake are known. The lake was named by the geologist Warren Upham in honor of Louis Agassiz, who was the first to make a systematic study of glaciers and glacial phenomena.

EDITORIAL*

WE ought to stop at intervals for stock-taking. We need to simplify our professional stock-in-trade; to eliminate the superfluous things that over-burden and distract our minds, and over-load our time. Simplification first, then concentration—that should be our aim. We drive ahead, constantly taking on new responsibilities. Our lives become more and more entangled with increasingly numerous duties. All of these must be attended to sometime. Most of them need attention all the time. Thus we live in our characteristic American whirl, too often doing each thing hurriedly and unsatisfactorily; wearing ourselves out by trying to do too many things at once.

Most of us will probably agree that we have what President Wilson has so well called a "single-track mind." Very few of us can manage the intellectual traffic on a four-track mind. We need to reduce the number of our trains; to change their schedule, so that they shall not be running so dangerously close together; to put our small individual stocks of fuel onto fewer locomotives, so that these few may make better time, and do more satisfactory work.

How can this simplification of our tangled and disappointingly inefficient professional lives be accomplished? There is no single simple formula which can be suggested in reply to this question. Each of us has his own problems, and must reach his own solution of them. The important thing is to take time; to sit down quietly and think; to spread out our whole stock of professional responsibilities and interests, and to eliminate those which we honestly feel are, or seem likely to be, the least worth while, whether for ourselves or for others. For some of us it may be a course of instruction which we have been called upon to give, and which we have insufficient time ever to prepare satisfactorily, perhaps because our vital interest lies along other lines. That instruction should be abandoned, or entrusted to some one else. Others of us may find ourselves swamped under the rising tide of geographical literature—a tide which never ebbs. We try to look it all over; to read most of it. The inevitable result is nervous mental indigestion. What is the remedy? Obviously to reduce our reading to a carefully selected few of the most important publications; to limit ourselves to subjects which are of the most immediate concern and interest to us, relying upon our published bibliographies to keep us informed concerning all other publications. Many of us are scattering our energies, and thereby decreasing our efficiency, by trying to prepare for publication too many things at once. Taking account of stock should result in our abandoning some of these undertakings—those least worth while—and in our making serious and fixed resolution to reduce all such "outside" activities to reasonable limits.

Simplify—then concentrate. We teachers, perhaps more than any other group of workers in our complex modern civilization, need to follow that rule.

ROBERT DE C. WARD

*We hope to be able to give our readers from time to time short editorials written by members of our contributing staff.—*Editor*.

IRRIGATION FROM A GOVERNMENT CANAL

A lesson for the 5A Class in Geography

WE have discovered from our study of the winds and rain that winds from the Pacific Ocean drop their moisture west of the Rocky Mountains and so have little left when they reach the east side. As a result there is very little rainfall in this region.

If there is little rainfall what effect will it have on the soil, the usefulness of this part of the country and its settlement? The soil might contain plenty of mineral elements but because of the lack of rain it has become very sandy and very little grows there except buffalo grass and sage brush. In some places there are vast regions where nothing grows. Great hills of clay are to be seen and the land is a barren waste.

Men found that the buffalo grass was very nutritious as food for cattle. Then they began to have great herds of cattle and some flocks of sheep. Because of the lack of rain the grass did not grow rapidly and so it took a great deal of land to furnish enough pasturage for even a small herd. The United States government gave free pasturage to all the people. Each man branded his own cattle and they roamed at will all over the vast tracts of land. Each fall there would be a round-up when the cattle from the range would be gathered into the corral and separated according to the brands and the calves branded. Some of the cattle were shipped and the rest turned loose again to roam over the western plains.

Few people were needed to herd the cattle and for miles and miles not a house was to be seen, except occasionally a small log house of the cattle rancher.

Later it was discovered that gold, silver and other metals could be mined in layers of rock beneath the surface of this western land. The people from the East hurried west, staking claims. Mining towns grew up sometimes in less than a week's time. Many of the people were disappointed. These turned their attention to farming along the streams.

Still vast acres of land were left unused as the years went by. As the East became more thickly populated people began moving west. Experts examined the western soil and found it very good for farm land. There was plenty of warm sunshine and rich soil if only they had rain to make the crops grow.

In Egypt there is very little rainfall and yet it is one of the oldest agricultural regions of the world. How are these people able to raise crops? Each year the Nile River overflows its banks spreading a rich silt over the land and thoroughly soaking the soil. They are able to raise cotton, corn, rice, wheat and many other things.

There are many large rivers which flow across the western plains but they seldom overflow their banks and then only for a short distance. In the spring these rivers are very large because they are fed with the snow

from the mountains and the spring rains. The rivers quickly carry all this water to the Mississippi River and then to the Gulf of Mexico and the Atlantic Ocean.

If this water could be saved and used to water the fields it would do much toward irrigating the dry western plains. How could this be accomplished? By building a dam and letting the water out only as needed.

President Roosevelt thought this could be done and secured from Congress an appropriation of two million dollars to build a government canal. Previous to this time there had been some irrigating done by canals built by individuals or by private companies.

Far back in the mountains at the source of the Platte River in Wyoming, a dam called Pathfinder, 196 feet high, 450 feet long and 90 feet wide at the base was built. This is a solid wall of granite with an opening at the base 14 feet square. An iron door which is worked by machinery can close this opening and not let any water through. This door is closed every Saturday to see that it is in good working condition. In August, 1914, after the water had been used for irrigating all spring and summer the Pathfinder Lake was one hundred eighty-five feet deep and seventy-five miles around and water was backed up for twenty-one miles. From this hole at the base of the dam twenty-three thousand acres are irrigated at one time. If there is no rain for seven years there is plenty of water stored in Pathfinder Lake to water the land.

From the Platte River, canals are built to carry the water. In these canals cement headgates are built to regulate the flow of water. The headgates are divided into different parts each having a separate iron door which slides up and down. The headgate at Whalen has nine separate openings. From the canals, laterals are dug to the different farms and from these irrigation ditches are dug to the fields. To irrigate, they dam the ditch with a wooden headgate or with earth. The water then overflows, watering five acres at one time. Each farmer pays one dollar and a quarter each year for the water right on his land. Land which was formerly barren now raises corn, wheat, alfalfa, sugar beets, vegetables of all kinds, berries and many kinds of fruit. The same land which twenty to fifteen years ago was not worth more than one to five dollars an acre now sells for fifty, one hundred and some even two hundred dollars an acre. Their crops are more certain than in Iowa and Illinois because we are dependent on the natural rainfall. Some years when there is too much rain here the farmers of the West simply do less irrigating and when the rainfall is slight they irrigate more.

FLORENCE M. SMITH,
DeKalb, Ill.

THE DETERMINATION OF MINIMUM ESSENTIALS IN ELEMENTARY GEOGRAPHY*

AT a meeting of the Committee on Economy of Time held in the fall of 1912 it was suggested that current literature could be profitably employed as a standard for determining the kind of geographical information that the school should provide. The proposal was to read current newspapers and magazines, record the geographical references, and determine from the frequency of these references the relative value of the various types of geographical information. Results of the application of the method presented at the meeting seemed to indicate that the content of geography as now taught in the elementary school would be greatly modified if materials were chosen upon this basis.

The writer set this problem as one of the topics in his graduate seminary in educational values during the spring of 1913. A large number of newspapers and magazines were read by members of the seminary, the geographical and historical references were recorded and classified, and an attempt was made to evaluate the general procedure as a means of determining minimum essentials in these two subjects.

Typical results of the initial tests.—From the reports of the members of the seminary who aided the writer in testing this method, the following tables of frequencies have been selected:

One member collected and classified the geographical and historical references and allusions in eighteen issues of the *Outlook* and the *Literary Digest*, representing a period of seven years ending with 1913. She found in these eighteen journals a total of 2,237 geographical references. The distribution was as follows:

	Per Cent
References to facts of location, size, direction, etc., which may be assumed to require for their understanding a knowledge of "place and location" geography.....	53.5
References to political divisions and facts of government which may be assumed to require a knowledge of "political" geography.....	25.1
References to industries, commerce, products, etc., which may be assumed to require a knowledge of "commercial" geography.....	5.8
References to people, customs, religion, education, etc., which may be assumed to require a knowledge of "social" geography.....	4.8
References to places as scenes of historical events, which may be assumed to require a knowledge of "historical" geography.....	1.7
Other references primarily of local or transitory interest.....	8.9

A grouping of this sort is obviously subject to the errors or peculiarities of individual judgment, but it may be said that the classification just presented is quite consistent with those furnished by other readers.

*Excerpts from a report by Professor W. C. Bagley, University of Illinois, in the Fourteenth Yearbook of the National Society for the Study of Education.

Another suggestive grouping is based upon the frequency of references to the various continents. If one is to read intelligently the journals which formed the basis of this test, one will find occasion to apply one's knowledge of the continents in approximately the following proportions (the maximum frequency of reference being represented arbitrarily by 100):

North America	100	Africa	4
Europe	73	South America.....	3
Asia	13	Australia	1

The principal European countries had an importance for the readers of the journals in question in the following proportions (giving England, as the country most frequently referred to, the arbitrary value of 100):

England	100	Italy	32
France	80	Turkey	30
Germany	70	Austria-Hungary	24
Russia	35	Spain	22

The countries and colonies of Asia show the following proportions of references as compared with England: China, 55; Japan, 50; India, 19; Korea and Persia (typical of the less important divisions), 4 each.

This order of frequency in references to European and Asiatic countries is fairly constant in the two reports which furnish comparable data.

The frequency of reference to cities is perhaps not so significant, although here, too, there is a goodly measure of similarity among the different reports. A combined rating, which may mean much or little, is given herewith:

FOREIGN CITIES (NEW YORK, 100)

London	31	Constantinople	12
Paris	26	St. Petersburg	7
Berlin	15	Vienna	7
Rome	12		

AMERICAN CITIES

New York City.....	100	Chicago	26
Washington	27	Philadelphia	20
Boston	27		

There is, in general, a direct although not a perfect correlation between the number of references to cities and the size of the cities—except, of course, that capitals of countries have an importance not always represented by their size.

Compared with references to countries and cities, the references to physical and physiographical features are not numerous. For readers of the journals used in the investigation, information about the following rivers seems

to be of the greatest importance and approximately in the order named for the first five: Mississippi, Hudson, Ohio, Missouri, Rhine, Nile, Danube, St. Lawrence, Potomac, La Plata, Seine, Niagara, Rio Grande, Columbia, Amazon, Congo. References to seas and gulfs follow in the following order: Mediterranean, Aegean, Mexico, Black, Adriatic, Marmora, Red, and Caspian. The straits most frequently mentioned are the Dardanelles, Bosphorus, Magellan, and Bering.

CURRENT GEOGRAPHICAL NOTES

UNCLE SAM'S LANDED ESTATE

Few Americans realize that the United States Government owns more than half of the land in the eleven states of the West. Here is the list:

State:	Total acreage owned by United States	Percentage of total owned by United States
Arizona	67,097,293	92.00
California	53,276,547	52.58
Colorado	37,702,033	56.67
Idaho	45,218,919	83.80
Montana	61,049,263	65.80
Nevada	62,219,423	87.82
New Mexico	49,315,409	62.83
Oregon	32,229,745	51.90
Utah	43,564,645	80.18
Washington	17,684,198	40.00
Wyoming	42,613,499	68.00

U. S. GEOLOGICAL SURVEY MAPS NOW OBTAINABLE FROM POSTMASTERS

The finest and most accurate maps of the United States are those made by the United States Geological Survey. This branch of the Government service prints more than 3,000 maps a day, or about a million a year, most of which are sold to the public directly from Washington. Book and stationery concerns in the larger cities of course handle these maps, but heretofore there has been no way in which the inhabitants of the small towns throughout the country could get them except by sending to Washington. Now, however, postmasters in towns and villages have the permission of the Post Office Department to handle these maps. When the Geological Survey prints a new map it sends a sample copy to the postmasters in the area covered, with the suggestion that they tack it up in a conspicuous place, where everyone calling for mail can see it. Only postmasters in regions that have been recently mapped have been asked to handle the maps, but the Geological Survey answers inquiries made by other postmasters, sending them a sample copy of the map that covers their district, if it has been mapped.

HEAVIER BUYING BY NEUTRALS

A year ago, when, as a result of the disarrangement of shipping and credits, exports from the United States to neutral countries began to fall off, there was much uncertainty as to the future of this trade. After the outbreak of hostilities a wave of optimism swept the country, an immediate and large increase in shipments to countries whose European sources of supply had been cut off or interfered with was looked for. This did not materialize, and there at once followed an equally strong wave of pessimism.

Throughout this period of doubt, with the pendulum swinging from one extreme to the other, there was a gradual growth in the opinion that sooner or later conditions in Europe would result in larger shipments from the United States to neutral countries. That is just what is happening at the present time.

The export returns of the United States for recent months prove conclusively that the neutral countries of the world are beginning to turn to the United States for the supplies of which they are in need, and which cannot be obtained in usual quantities—in some lines not at all—from the usual European sources. This larger buying in the United States by neutral countries was first indicated in the returns for the month of May, it became quite pronounced in June and continues until the present time.

A few figures taken from the official export returns of the United States for the month of June are interesting as indicating the extent of this trade expansion. Exports to South America in that month amounted to $13\frac{3}{4}$ million dollars and were over 80 per cent in excess of the exports in the same month a year earlier. Argentina and Brazil in particular bought more heavily; exports to the former more than doubled and to the latter almost doubled. Purchases by Colombia, Ecuador, Uruguay and Venezuela, of much smaller proportions, were in each case approximately twice as large.

Though South American countries lead the way in the buying of supplies from the United States, there has been an expansion in the exports to all neutral parts of the world. Exports to Asia in June showed approximately the same total and the same increase as those to South America. There was an increase of 25 per cent in the exports to Oceania and the West Indies and of 33 per cent in those to Africa.

As stocks become more depleted and as the demand in different lines becomes more pressing this expansion in the exports from the United States to other neutral countries of the world should gather impetus with each passing month.—[*Commercial America*.]

ARGENTINE MEAT TRADE

In an article in the New York Journal of Commerce, A. D. Melvin, Chief of the Bureau of Animal Industry, and George M. Rommel, Chief of the Animal Husbandry Division, Bureau of Animal Industry, say:

"The growth of the meat trade in the Argentine Republic has been little short of remarkable, and its importance in the world's commerce is greatest in beef products. Although the exports of mutton from Argentine rose from less than 200,000 carcasses in 1884 to over 2,000,000 in 1895, they have grown rather slowly since that year, exceeding 3,000,000 in 1902 and reaching the high point of 3,679,587 carcasses in 1904. In 1913 fewer carcasses of frozen mutton were exported than in any year since 1896.

"The area of the Argentine Republic is in round numbers 1,138,000 square miles. On this area there are 29,000,000 cattle, 80,000,000 sheep and 3,000,000 hogs. Argentina ranks next to Australia in number of sheep, but is fourth in number of cattle, European Russia, the United States and British India far outnumbering her in this respect. In the hog industry she is a negligible factor.

"On this area of over one and one-eighth million square miles there are twenty-five cattle per square mile, very few of which are used for dairy purposes, and an average of seventy sheep per square mile, nearly all of which are used for wool production. The United States, on the other hand, has on its continental area of almost 3,000,000 square miles an average of only nineteen cattle per square mile. As against Argentina's seventy sheep per square mile we have seventeen, but the mutton qualities are more strongly developed in our sheep than in those of Argentina."

THE EARTH HAS HAD MANY "ICE AGES"

It is not strictly correct to speak of the "ice age" or the "glacial epoch," for there have been many of them. It is now known that even this latest or Pleistocene glacial epoch has several important divisions, and in the Rocky Mountain region it appears that important changes in the form and height of the mountains, due to a wearing down by erosion, took place between the glacial subepochs.

More than 50 years ago it was recognized by English geologists that certain masses of gravel and breccia and certain planed and grooved rock surfaces in rocks of Permian age in India indicated a glacial epoch vastly older than that of the Canadian ice sheets, but it is only within the last 30 years that geologists have learned that glacial conditions have recurred at many different times in the earth's history. The evidence of this has been found in all continents, in Europe, Asia, Africa, Australia, South and North America. The formation of great ice sheets took place at different periods in the larger divisions of geologic time back to the Proterozoic—that is, to the age of the oldest known sedimentary rocks, a great many million years ago.

One of the most recent discoveries of old glacial deposits is that made by Prof. W. W. Atwood, of the United States Geological Survey in southwestern Colorado. Prof. Atwood's report of this discovery has just been issued by the United States Geological Survey as part B of Professional Paper 95. Copies of the report may be had on application to the Director of the United States Geological Survey, Washington, D. C.

COMPARATIVE WEALTH OF NATIONS

Estimated wealth of different countries.—Owing to the insufficiency of official and trustworthy data pertaining to the subject, it has been impossible to prepare a summary of the aggregate wealth of all nations. The following statement summarizes the information concerning the wealth of the principal nations as it has been assembled by Augustus D. Webb, Fellow of the Royal Statistical Society, and published in "The New Dictionary of Statistics" for 1911.

United States (last census estimate) year 1912, total wealth. \$187,739,000,000
 British Empire, year 1903, total wealth \$108,279,625,000

United Kingdom, year 1903, total wealth	\$ 72,997,500,000
Canada, year 1903, total wealth	\$ 6,569,775,000
Australasia, year 1903, total wealth.....	\$ 5,353,150,000
India, year 1903, total wealth	\$ 14,599,500,000
South Africa, year 1903, total wealth.....	\$ 2,919,900,000
Remainder of Empire, year 1903, total wealth.....	\$ 5,839,800,000

France, private wealth	\$ 46,798,500,000
Denmark, year 1900, total wealth	\$ 1,946,600,000
Germany, year 1908, total wealth	\$ 77,864,000,000
Australia, year 1903, private wealth	\$ 4,578,903,000
Cape of Good Hope, year 1907, fixed property.....	\$ 428,939,492

AN ANCIENT VOLCANIC ERUPTION IN ALASKA

Every traveler on the upper Yukon River has noticed a conspicuous white bed, 4 to 6 inches in thickness, that occurs on the river banks. This is made up of volcanic ash derived from a volcano located in the northern margin of the St. Elias Range more than 100 miles to the south. Though geologically speaking the material is of recent age, yet it was probably erupted 1,400 years ago. There are, of course, no historical records of this eruption, but in the course of explorations in Alaska much has been learned about the distribution and thickness of the material ejected. It originally covered an area of over 140,000 square miles, and some of it was carried over 450 miles from the volcano. The deposit varies in thickness from 300 feet near the volcano to an inch or two at the margin of the area covered by it. A rough estimate indicates that over 10 cubic miles of material was ejected at the time of this eruption. During the eruption of Katmai volcano in southwestern Alaska in June, 1912, about 5 cubic miles of ash was ejected, and about the same amount fell from the Krakatoa eruption of 1883. This Yukon eruption is therefore comparable in intensity with some of the larger eruptions of historical time. All the available information about this subject is summarized in a paper entitled "An ancient volcanic eruption in the upper Yukon basin," by Stephen R. Capps, issued by the United States Geological Survey as Professional Paper 95-D.

TOTAL WEALTH OF STATES
U. S. Census Estimate for 1912.

	Total	Per Capita		Total	Per Capita
Total U. S.	\$187,739,071,090	\$1,965	South Atlantic	14,843,963,211	1,179
New England	11,805,422,012	1,744	Delaware	307,348,613	1,493
Maine	1,069,594,027	1,420	Maryland	2,177,958,864	1,661
New Hampshire...	649,320,469	1,493	Dist. of Columbia.	1,173,857,112	3,425
Vermont	527,261,775	1,470	Virginia	2,289,913,786	1,086
Massachusetts ..	6,302,988,392	1,805	West Virginia....	2,303,571,209	1,800
Rhode Island....	970,802,690	1,709	North Carolina...	1,807,573,780	794
Connecticut	2,285,454,659	1,969	South Carolina...	1,351,400,753	869
Middle Atlantic....	46,211,667,778	2,290	Georgia	2,332,600,866	833
New York	25,011,105,223	2,626	Florida	1,049,138,228	1,307
New Jersey	5,743,032,278	2,140	East South Central.	7,660,040,736	890
Pennsylvania	15,457,530,277	1,939	Kentucky	2,267,777,525	977
East North Central.	39,502,313,584	2,106	Tennessee	1,920,348,261	864
Ohio	8,908,432,943	1,817	Alabama	2,127,054,930	964
Indiana	5,194,682,500	1,894	Mississippi	1,344,860,020	726
Illinois	15,484,450,232	2,660	West South Central.	15,434,960,541	1,662
Michigan	5,427,022,651	1,873	Arkansas	1,329,521,736	1,120
Wisconsin	4,487,725,258	1,875	Louisiana	2,164,437,746	1,260
West North Central.	31,208,417,942	2,617	Oklahoma	4,581,091,918	2,475
Minnesota	5,547,327,017	2,582	Texas	6,859,909,141	1,679
Iowa	7,868,454,211	3,539	Mountain	6,753,014,065	2,371
Missouri	5,842,017,009	1,752	Montana	1,149,732,986	2,834
North Dakota....	2,141,626,961	3,374	Idaho	608,305,157	1,680
South Dakota....	1,398,573,425	2,239	Wyoming	353,844,827	2,241
Nebraska	3,794,986,781	3,110	Colorado	2,386,923,583	2,785
Kansas	4,615,432,538	2,652	New Mexico	513,733,026	1,440
			Arizona	501,852,186	2,355
			Utah	781,613,390	1,979
			Nevada	457,008,910	5,038
			Pacific	13,626,919,363	2,969
			Washington	3,218,360,623	2,511
			Oregon	1,944,354,463	2,661
			California	8,464,204,277	3,284

By addressing the Director of the Bureau of the Census, Washington, D. C., a Bulletin on the Estimated Valuation of National Wealth may be obtained.

OLIVES AND OLIVE OIL

While the original home of the olive is claimed to be in India, the Mediterranean region without doubt is the one with which the historical knowledge of the olive is associated. The northern limit of the olive belt touches the forty-fourth parallel, and in a few favored locations extends to the forty-fifth. The southern limit, like the isothermal line, varies from the twenty-fifth to the eighteenth.

Today, as of old, the great producing countries are situated in this region, the average annual production being about 800,000 tons of olive oil. Of the total production in 1912, Spain furnished 240,000 tons; Italy, 235,000 tons; Asiatic Turkey, 180,000 tons; Greece, 55,000 tons; Portugal, 35,000 tons; France, 30,000 tons; Tunis, 25,000 tons; Algeria, 20,000 tons, and Austria, 5,000 tons.

While a large part of the production of these countries is consumed at home, a large amount is also exported. The exports from Algeria and Tunis are mainly to France, and the exports from Greece are mainly to Italy and France, although both of these countries produce oil on a much larger scale than Greece. Italy takes about one-half of the exports from Greece, or about 2,000,000 gallons in good years; France buys about 1,000,000 gallons from the same source, and Russia, 375,000 gallons. The United States is the best customer for Greek olives, a black fruit preserved in brine.

Spain, which is the largest producer of olives, exported olive oil in 1914 valued at \$9,000,000 and olives valued at \$2,300,000. The second largest producer of olives is Italy. Marseilles is the leading olive oil trade center, followed by Nice. Larger quantities of olive oil pass through Marseilles than any other city.

Oil is better for being pressed immediately after the fruit is taken from the tree; therefore, most of the pressing is done in the region where the olives are grown and not in large factories as is the case with seed oils.

Olives are produced to some extent outside of the Mediterranean region—in the United States and Australia. The State of California produces nearly all the olives raised in the United States. The value of the crop is estimated at \$2,000,000. The general working basis in California is about 20 per cent of pickled olives and 80 per cent of olive oil.

The olive was introduced into California at the San Diego Mission from Lower California soon after 1769, and between that date and 1823 was planted in most of, if not all, the twenty-one missions of the coast. The mission variety has been largely supplanted by improved varieties imported from France and Italy. The leading centers of olive production are Pomona, in Los Angeles County and San Diego and Santa Barbara Counties.

The olive industry has been growing rapidly and what it needs mainly is protection against adulteration. Large quantities of cottonseed oil are sent to olive producing regions of Italy and France, and mixed with olive oil and then reshipped to this country as pure oil.

One feature about the cultivation of the olive is its suitability for growing under arid conditions, and therefore it can be made a profitable crop in the warmer parts of arid and semi-arid districts in western Texas, southern Arizona and California.

The development of a taste for olive oil in the United States was at first very slow. In 1876 only 178,000 gallons were imported; in 1896, 942,000 gallons; and in 1904, 1,937,632 gallons.—[*Commercial America*.]

THE GROWTH OF GEOGRAPHICAL ORGANIZATIONS

THE movement for the organizing of teachers of geography is making excellent progress. Minnesota has formed a state association and the twin cities—Minneapolis and St. Paul—under the leadership of Prof. E. J. Posey of the State University, have organized a large and vigorous society. Indiana recently formed a state organization and elected Prof. B. F. Schockel of the Terre Haute Normal School president.

California has organized a society including the teachers in the region around San Francisco Bay with Prof. Earle G. Linsley of Mills College as president.

North Dakota organized recently and elected Prof. Howard E. Simpson of the State University as president.

Illinois has organized under the leadership of Miss Mabel C. Stark of the State Normal University.

At the annual meeting of the Wisconsin Geographical Society at Milwaukee, November 5, it was voted to federate with the national organization now forming. President W. J. Sutherland of the Platteville Normal School was elected president of the State Council. It was voted to divide the state into nine districts each centering around a normal school, and to ask the head of the department of geography in each of these schools to act as a district leader in matters pertaining to geography. The plan contemplates the organized study of local geography, the providing of speakers on geography for the county and district teachers' associations and the preparation of papers for educational periodicals.

AGRICULTURAL ATLASES

THERE are in the course of preparation in the Office of Farm Management in the U. S. Dept. of Agriculture two publications which promise to be of considerable interest to teachers of Economic Geography. They are to be called Atlases of American and of World Agriculture. The former is to be a most important contribution to geography but will not likely appear until 1917. Some advance maps from it are, however, to appear in the Yearbook of the Dep't. of Agriculture for 1915.

The Atlas of World Agriculture is to show by dot maps the distribution of important crops and animal industries in the chief producing countries of the world. There are to be about 100 maps and about 30,000 words of descriptive and explanatory text. The value of the maps to teachers is to be increased by the addition of large numbers of diagrams showing the comparative acreage, production and yields of crops in important countries. Other diagrams are to show numbers of animals and the trade in agricultural products. It is hoped that this atlas may be available early in 1916.

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SUPPLYING THE WORLD'S COFFEE

By Chester Lloyd Jones

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ONE of the most remarkable developments in the increased use of tropical agricultural products is the rapid growth of the use of coffee. Formerly a luxury within the reach of only the well-to-do it has become a necessity for all classes. During the process of the change in its use the old world has ceased to be the source of supply yielding position to the American tropics. But little over one-fourteenth of the total in export trade now comes from countries outside the new world.

BRAZIL THE GREAT PRODUCER

In America up to the present time coffee raising is still predominately an industry of a single region—south central Brazil. In 1913-1914 the Brazilian production was estimated as 13,845,000 bags in a world's total of 18,690,000. Of this enormous amount 10,250,000 came from a single province Sao Paulo and was shipped from the single port of Santos, the greatest coffee-shipping center of the world. It was officially announced in July of 1915 that the crop in Sao Paulo in 1915 would be 12,000,000 bags. Ninety-nine per cent of the exports from Santos consist of coffee*. The only other city worthy of mention as a coffee port in the same class as Santos is Rio de Janeiro which ships about 3,000,000 bags annually†. The total export from Brazil for the year ending July 31, 1915, was 13,401,515 bags.

The great coffee regions are most easily reached by taking the railway for the interior at Santos which lies at the foot of an abrupt rise leading to the plateau, the red earth of which has proved itself the finest soil in the world for producing the berry. So steep is the rise to this territory that we ascend on a railroad on which there is added to the usual engine motive power, a cable traction system which helps pull the load up from one station to another. This railroad is said to have been—length considered—the most expensive undertaking of the kind in the world. Loaded cars go down one track while empty

*Commerce Reports, Supplement, Nov. 16, 1915.

†The Commerce Reports, September 10, 1915, report from Rio de Janeiro under date of July 26, 1915, that reliable private estimates of the Brazilian crop for 1915 place the Sao Paulo crop at 14,000,000 bags and the total for Brazil at 22,500,000 bags. The figures used in the text above are from the report cited, Commerce Reports, October 30, 1915, and the estimates of Duuring and Zoon of Rotterdam furnished by the Coffee Exchange of New York.

ones, or ones filled with inbound freight, ascend the other. So heavy and valuable are the outgoing shipments, almost entirely of coffee, that the road pays high dividends in spite of upkeep and operating costs which would under ordinary circumstances be prohibitive.

PICKING AND PREPARING THE COFFEE

The coffee plantations vary all the way from holdings of fifty or a hundred acres to great *fazendas* on which the orderly rows of olive-green trees stretch away as far as the eye can reach. The harvest extends over a comparatively long season, pickings occurring practically continuously from May to September. The processes of getting in the crop are simple and require only unskilled labor. When the berries are ready for gathering the laborers pick them in wicker baskets. All ages and all colors of people are represented among the workers. Indians, Portuguese, Italians, Spaniards and even Japanese and Chinese are found in the plantations in large numbers. When picked the beans as we know them are encased in a pulpy substance. This is removed in two ways. The modern method involves the use of machinery of expensive character but the more primitive and still the usual way is to spread the berries out about six inches deep on a drying floor. There the sun's heat in two or three weeks dries the pulp which is then removed from the beans—of which there are two in each berry—by means of a hulling-machine.

When shipped to the coast the beans are in heavy hemp bags weighing when full sixty killos or 132.28 pounds each. These are taken to great storage houses where they are emptied and the beans are sorted. The interior of these enormous buildings indeed, even the whole neighborhood in which they lie is permeated by the appetizing odor given off by the green coffee. The finest grades are picked out by hand, the commoner ones are separated by great steam driven machines handling thousands of bags per hour. After sorting the coffee is again put into sacks which are stacked into great piles waiting for loading on steamers for the overseas trade. The sacks themselves are marked with a government stamp showing that the export tax on the contents has been paid. Without these marks the shipment is not allowed. Almost all the best coffees are said to be sent abroad. Some of the chief dealers in the great consuming countries, especially those in the United States, have their own sorting and storing establishments and hold their stocks of coffee in Brazil until the product is needed in the home market.

THE EFFORT TO STABILIZE THE COFFEE INDUSTRY

So richly endowed is Brazil with lands suited to the raising of coffee that the production constantly tends to outrun the ability of the world to consume the crop at prices which will give a reasonable profit above the cost of production. It not infrequently happens in fact that a poor season will bring the grower a better money return than a year in which his trees bear exceptionally well. To eliminate the chance that the very success of the planters in their

cultivation shall not prove their undoing has been the object of various schemes undertaken by the government to stabilize the price of coffee. Efforts have been made, without marked success, to restrain the planting of new trees. Later what was known as the "valorization" scheme was put into operation. Under it the central government undertook to lend to São Paulo money which was raised by an issue of bonds. In all the state borrowed in this way \$127,500,000. A tax of four francs per sack exported was levied to pay off the indebtedness. The government was to buy coffee and store it in years of bumper crops. Thus the amount which would be thrown on the market from year to year could be regulated and the government by reducing the supply could assure that coffee would not be sold at less than a price which would yield a reasonable profit to the grower. For a variety of reasons this plan also failed though apparently the Brazilians are even yet believers in its fundamental soundness. The rapid fall in price in recent years has caused a revival of the projects for price control. In 1912 the average price per sack was about \$19.00. In 1914 it was \$9.00. There is now under discussion a second valorization scheme which the planters hope may escape the unfortunate fate of the first.

THE INTEREST OF THE UNITED STATES IN COFFEE

Of all countries in the world besides Brazil probably the United States has the greatest interest in coffee. With us the concern is that of the consumer, not of the producer. We drink far more coffee than any other nation. In 1914-15 we imported 1,118,690,524 pounds of which all but 66,974,501 staid in the country for consumption. Our total imports from Brazil were 5,880,619 bags in the year ending July 31, 1915. On the average we use ten pounds of coffee per year for every man, woman and child in the country. About seven out of every ten pounds we use come from Brazil.

So much a necessity has coffee become that we have adopted toward it the most liberal of tariff policies. We admit it free from all customs charges. Whenever it is proposed to make coffee pay duty on entry the argument against "taxing the poor man's breakfast" is always powerful enough to quiet discussion. On the other hand Brazil has shown that she realizes how important our market for coffee is to her by granting us tariff treatment of a peculiarly favorable sort. It might be supposed that since our own people seem determined to have coffee tax free, that the Brazilians would decide there was no necessity for giving us in return for our market any special favors in her own trade. But they have preferred to give no reason for dissatisfaction to their best customers and since 1904 they have put us in an especially favored position in their import trade. In 1899 a law was passed by the Brazilian Congress authorizing the President to make certain tariff reductions to countries which established favorable conditions for Brazilian trade. Acting on this authority in 1904 a reduction was granted to us of 20% on the Brazilian tariff on certain named articles. The list has since

been lengthened and on flour we now have an advantage over other states amounting to a 30% reduction from the regular tariff rates. We are the only country in whose favor up to the present time the President of Brazil has seen fit to exercise his power to reduce the tariff. In fact we are the only country it seems, in whose favor it was intended the power should be exercised, for bills have been introduced into the Brazilian Congress to limit the favor to countries importing coffee to a yearly amount greater than 4,000,000 sacks. No country but the United States stands in this class.

It is easy to understand why the Brazilian public should desire to remain on good commercial terms with a country which took in 1915, 5,880,619 bags, representing a market value of more than one sixth of the total export trade. Indeed it is said that when a few years ago the Brazilian minister intimated that the concession might be discontinued, a suggestion that in that case the United States might conclude to tax coffee from Brazil was quite enough to induce assurances that no change in prevailing practice would be introduced. Under this law granting us special favors American flour, clocks, watches, paints, rubber manufactures, scales, pianos, and typewriters have come to dominate the market in the northern ports of Brazil—a condition which, as indicated above, is directly attributable to the position we hold in her coffee trade.

OTHER AMERICAN COFFEE-GROWING COUNTRIES

But unfortunately for Brazil her lands are not the only ones in America which are suited to the growing of coffee. Around the Caribbean are a group of countries whose coffee production is rapidly growing and which produce in the opinion of many connoisseurs a grade far superior to that from their great southern competitor. Then too these lands lie in a region where they are peculiarly accessible to the American market. Near at hand they are naturally the first area which attracts the attention of the American manufacturer ambitious to develop his export trade or to venture in foreign investments. Unfortunately therefore for Brazil she must look to these regions not only as ones which may in the future seriously cut into her coffee trade with the world at large but they are especially apt to do so in the trade with her best buyer.

Why Caribbean coffee resources have not been relied upon to a greater extent by American importers is explained in several ways. It is insisted that the Brazilian berry has so established itself with the American public that the flavors of the varieties from other countries do not commend themselves. Unsettled political conditions in some of the Caribbean countries have made the supply uncertain. The amounts purchasable, partly due to the civil disturbances so frequent there, have been small compared to that available in Brazil, therefore the tendency has been to turn to the greater market, finally adverse tariffs have turned the Caribbean coffee away from us in some instances. While Porto Rico was a colony of Spain its coffee by tariff arrangements was

largely deflected from us. As a result even at the present time we take only a small proportion of the coffee exported from our own Caribbean colony. The present French reciprocity treaty with Haiti doubtless draws her coffee toward that country, and her tariffs in her own colonies have a similar effect.*

CARIBBEAN COFFEE GROWING IN FAVOR

But our failure to appreciate Caribbean coffee is passing away. Gradually our tastes are being educated to an appreciation of the good qualities of sorts other than those from Brazil. It is still true that even Porto Rican coffee goes in normal years chiefly to France and Spain, Nicaraguan coffee to France, Guatemalan to Germany and that of Salvador to France and Germany. Nevertheless we are playing an increasingly more important part in the Caribbean coffee trade. We have already taken first place in the Venezuelan exports and occupy an important position in Colombia. The war has temporarily at least put us into first place in the Nicaraguan market. Taking our coffee trade with the Caribbean as a whole in the years since 1912, an increase of \$11,386,992 is registered while in the same period our importations from Brazil showed a decrease in value of \$22,375,171, though the amount imported did not fall. Central America in these years increased its shipments to the United States by over 43,000,000 pounds, Colombia by 23,000,000 pounds and Venezuela by a similar amount*. This period is a short one but the tendency it shows seems not likely to be reversed especially in view of our increasing general export and import trade connections with Caribbean countries.

The more important units in coffee production in America other than Brazil are Mexico and Central America producing about 1,600,000 bags per year, Venezuela and Colombia producing about the same amount, Haiti with about 500,000 bags, and the other West Indian units producing about 225,000 bags. Though these do not make an important showing against the total from Brazil they are of significance when compared with the other sources of supply in the world and the figures of their production help to demonstrate to what a degree the coffee trade has come to depend on new world production. Outside of America the only important contributors are Africa, producing about 150,000 bags and the East Indies with about a million bags. In other words, of the world's supply in 1914-15 over fifteen-sixteenths came from the new world.

THE EUROPEAN WAR HAS NOT SERIOUSLY AFFECTED THE INDUSTRY

At this time when the world's markets are being so seriously disturbed by the European war it is interesting to see what effect the conflict has had upon the prosperity of this distinctively American product. In none of the great producing areas of the world has the war caused serious interruption of the

*Commerce Reports, Sept. 10, 1915.

opportunity to raise the crop. There has been no important drafting off of the laborers to fight battles nor devastation of the plantations. Further, since coffee trees once established remain in bearing for a number of years, there is little effect upon the crop raised exercised by any sudden contraction of credit. The elements which might most easily affect the situation are: (1) the lack of money to pay the laborers in harvesting the crop, and the expenses attendant on its marketing, (2) the added insecurity of overseas shipments and the price obtainable in the countries of consumption.

In spite of the fact that the coffee raising countries are typically debtor countries, relying largely on loans from abroad for the current expenses of raising the crop, there seems to have been much less difficulty in getting the coffee to market than was feared. German money finances the coffee crop especially in Guatemala and Colombia and distress in both these districts was prophesied on the outbreak of the war. But the export statistics show that not far from what was to be expected reached the foreign market. In some countries marketing was interfered with by local political disturbances notably in Mexico and Haiti but the European war in general had comparatively little effect on the actual marketing.

Brazil's export of coffee during the first year of the war was only seven per cent below that of the previous twelve months. The business was disorganized during the first months of the conflict but with the defeat of the German fleets shipping connections became almost normal again, and the great use of the beverage by the armies in the field seems to have kept the market active. There were of course no direct shipments in the period to Germany, Austria-Hungary and Belgium but shipments to Denmark, Norway and Sweden were ten times as great as in 1914*. In Colombia and Venezuela, where it was reported shortly after the outbreak of war that the price of coffee was so demoralized that it would hardly pay for harvesting the crop, conditions had become about normal by July, 1915.

From Central America came varying reports but most of the countries were not seriously inconvenienced. Honduras, weakest of all, had a more prosperous season than she had experienced for years. Nicaragua, so far as her prosperity depended on the coffee trade, was almost as fortunate. It is estimated that about 93 per cent of the coffee exported leaves the country before the end of June. She had therefore marketed her 1914 crop before the war broke out and the next crop was not ready for shipment before conditions had again become stable. Though she lost her market in the central European countries the United States and the United Kingdom bought more liberally than usual so the market experienced but little difficulty. The other coffee producing countries, with the exception of Haiti, in which the revolution crippled production, gave similar reports.

*Commerce Reports, October 13, 1915 (dated September 4, 1915).

Other lines of export representing goods which are to a less degree necessities of modern life worked under serious limitations but coffee has now come to be so widely used that even such a far reaching conflagration as that which now engages the world affects its market only in a minor degree.

THE CATTLE INDUSTRY IN URUGUAY

UP to the end of the 16th century there were no domestic animals in Uruguay. In 1603 a hundred head of cattle were imported from Argentina. By 1624 they had multiplied to a remarkable extent and a settlement was founded for the purpose of hunting the wild cattle and trading in their hides. Because of poor transportation, the beef had no market value, while the skins were sent to Buenos Aires or to Spain.

Among the privileges granted the earliest permanent settlers in 1723, were a range of approximately 5000 acres and 200 head of cattle. As the accumulation of land was not prohibited, enormous estates were formed, some of which still amount to 50,000 acres, and are entirely devoted to cattle raising.

In 1754 the first 'saladero' (an establishment for salting and drying meat) was built. At the beginning of the 19th century there were more than half a dozen of these saladeros. Not until 1860 were any steps taken to improve the native cattle. Since that time English beef breeds have been introduced and are still being purchased in considerable quantities.

Formerly all of the animals ranged freely on the pastures, the limits between the various estates being marked only by boundary stones. Later the building of walls and in 1875 the construction of wire fences made enclosures which separated the various estates and sometimes subdivided them.

The export of Argentine beef began in 1780 with the first shipments of jerked or dried beef. This industry increased the price of cattle five-fold. At present there are in Uruguay 16 salting establishments, 5 preserved meat factories, and 2 cold storage establishments. In 1904 the first cold storage works were erected in Uruguay with capital raised in the country itself. They have a capacity of 400 head of cattle and 4000 sheep daily. The value of the animal products exported from Uruguay during the five years 1903 to 1907 amounted to about \$170,000,000.—From the Monthly Bulletin of Agricultural Intelligence and Plant Diseases, May, 1914.

A CORRECTION.—It was recently stated in this Journal that the Twin Cities, St. Paul-Minneapolis had formed a joint Geographical Society. This was an error. Each city has its own society; L. L. Everly of the St. Paul Normal School is president of the St. Paul Society, and C. J. Posey of the State University is president of the Minneapolis Society.

SUPPLEMENTARY MATERIAL FOR TEACHING GEOGRAPHY IN ELEMENTARY SCHOOLS

By J. W. Hubbard

Normal School, Worcester, Massachusetts

DESCRPTIONS in text books on geography are so brief and so lacking in detail that the subject needs enrichment by much supplementary study. Geography may be viewed from many angles. It may be interpreted by the study of various kinds of maps—political, physical, and relief. The distribution of cities, products, races, industries, transportation lines, climate, and surface features may be expressed by the pupil through the outline map. Books of travel, geographical readers and an unlimited wealth of illustrations available everywhere give broad views of life in all parts of the world.

Many teachers and schools would avail themselves of material that will give form and life to the skeleton of the text if they knew what to select for different grades and where it can be obtained. To furnish such information is the purpose of this paper. No claim is made that the lists given are complete or even that the items mentioned are the best of their kind; they have been selected merely as valuable sources, that have been used and tested in this school.

BOOKS

Explanation of Abbreviations: Ed. Pub. Co.=Educational Publishing Co., Boston; Ginn=Ginn and Co., New York or Boston; A. B. Co.=American Book Co., New York; R. McN.=Rand, McNally and Co., Chicago; Appleton=D. Appleton and Co., New York; Macmillan=The Macmillan Co., New York; S. B. & Co.=Silver, Burdette & Co., Boston; H. M. & Co.=Houghton, Mifflin and Co., New York; Holt=Henry Holt and Co., New York.

A teacher ought to be provided with enough duplicate sets of books to give all pupils a chance to use them.

Schools are given a liberal discount from the list prices which are here quoted.

Grades III and IV

Home Geography for Primary Grades, by H. W. Fairbanks. Ed. Pub. Co. 60c.

Earth and Sky, by J. H. Stickney. Ginn. 40c.

Geographical Nature Studies, by Frank O. Payne. A. B. Co. 25c.

Little studies in climate such as "The air," "Where the rain comes from," "The seasons." Other topics are, "Stream systems," "Water in the ground," "Pools, ponds, and lakes." Leading occupations are also treated. Supplementary questions for the pupil to answer and suggestions to the teacher make this little book very valuable.

The Four Wonders, by Elnora E. Shillig. R. McN. 50c.

Tells about the production of cotton, wool, linen, and silk. The many illustrations are very fine and the style is well adapted to third grade children.

Eskimo Stories, by Mary E. Smith. R. McN. 40c.

Simple and well illustrated. This book describes all features of eskimo life from a child's point of view. The pictures of games, house, food, clothing, and weapons appeal to children.

Children of the Palm Lands, by Alice E. Allen. Ed. Pub. Co. 50c.

A simple account of the hot belt products including bananas, spices, tea, coffee, chocolate, and dates.

Big People and Little People of Other Lands, by Edward R. Shaw, A. B. Co. 30c.

Very pleasing descriptions of interesting people in India, Japan, Philippines, Africa, Russia, Holland, and Arabia. The many illustrations are excellent.

Seven Little Sisters, by Jane Andrews. Ginn. 50c.

These simple stories of extreme types of customs and environment introduce children to the life of people in the world at large.

Each and All, by Jane Andrews. Ginn. 50c.

A companion volume to the former book. It tells more stories about the same little people.

Grades V and VI

Bud and Bamboo, by John S. Thompson. Appleton. 30c.

In this story a boy and his sister visit China and see games, pets, a school, a silk farm, a rice field, a pagoda, examinations, a New Year's festival, and a funeral.

Children of Japan, by C. Campbell Brown. Frank H. Revell Co., N. Y. 60c.

Describes Japanese children in their homes and at school; their games, festivals, and superstitions. The same author has written other volumes about the children of India, Africa, Arabia, China, Egypt, Ceylon, Persia, and Borneo.

Stories of China, by Mary L. Pratt. Ed. Pub. Co. 50c.

Stories of India, by the same author. 50c.

Among other things this book describes the religions of India in a way that can easily be understood by children.

Peeps at Many Lands, by John Finnemore. Macmillan. 50c.

The complete series consists of about thirty volumes covering nearly the whole world. Each book contains twelve full page illustrations in color. For list of titles write to the publishers.

Youth's Companion Series, by M. A. L. Lane. Ginn.

The Wide World. 30c.

Some of the titles are, "A school in Cairo," "Some South American games," "Boys and girls of Paris."

Northern Europe. 30c.

Describes "A Russian village," "Scenes in Belgium," "A glimpse of Switzerland," "A Holland dairy," and other places.

Under Sunny Skies (Mediterranean countries) 30c.

Toward the Rising Sun (Asia and eastern lands) 30c.

Strange Lands Near Home (Canada, Mexico, South America) 30c.

Little People Everywhere Series, 12 Volumes, by Etta B. McDonald and Julia Dalrymple. Little, Brown & Co., Boston, Mass. 60 cents each.

Manuel in Mexico

Ume' San in Japan

Rafael in Italy

Kathleen in Ireland

Colette in France

Fritz in Germany

Gerda in Sweden

Boris in Russia

Betty in Canada

Donald in Scotland

Martha in Holland

Hassan in Egypt

Josefa in Spain

Each of these little volumes is a story of children's experiences at home and in other parts of the land in which the scene is laid. In telling the story the most picturesque customs of the people in the city and in the country are introduced. The series is a most valuable reference for getting vivid conceptions of the spirit and atmosphere of the places described.

Around the World—Book Four, by Clarence F. Carroll. S. B. & Co. 45c.
Descriptions of the United States.

Around the World—Book Five, by the same author. 60c.

The British Empire and Italy including all their colonies are treated rather fully but in a simple style.

A Series of Industrial Readers, by James F. Chamberlain. Macmillan. 40 cents each.

How We Are Clothed

How We Are Sheltered

How We Are Fed

How We Travel

Descriptions and illustrations of plants and other sources of clothing, food, and shelter, used by people in various parts of the world. A simple and very brief account of some processes of manufacturing is usually given.

Stories Retold from St. Nicholas, Century Co., New York, 65 cents each.

Western Frontier Stories

Stories of Strange Sightings

Stories of the Great Lakes

Sea Stories

Island Stories

Southern Stories

These stories are not strictly geographical but they are good reading, as the scenes and characters are typical of distinct regions.

Grades VII and VIII

Carpenter's Geographical Readers, by Frank G. Carpenter. A. B. Co. 60c each.

North America

Asia

South America

Africa

Europe (70 cents)

Australia and the Islands of the Sea

Many geographical readers, like our text books, are so meager and condensed that they make very little impression upon the pupil, but this standard series of readers gives full descriptions of every phase of life in the countries included. Excellent maps enable the pupil to follow the route which the journeys describe.

Type Studies from United States Geography, by Charles A. McMurry. Macmillan. 50c.

Full and rich descriptions. The author suggests that these type studies may be run parallel with the regular lessons to enrich special and important topics. The book has chapters entitled "The Hudson river," "Cod-fisheries," "Lake Superior," "A cattle ranch," "A trip on the lower Mississippi," "An orange grove in Florida."

Representative Cities of the United States, by Caroline W. Hotchkiss. H. M. & Co. 60c.

The cities selected represent great centers of industry and life. Just enough history of the city is given to explain how it is a response to its physical and economic environment. These descriptions are not travel sketches, but are geographical studies, by an experienced teacher who visited and studied every city which she describes. In connection with each city suggestions are given for additional investigation.

Asia, by Ellsworth Huntington, R. M. & Co. 75c.

This is the first book of a new series of readers now being issued. It is a very attractive and readable volume; the information is up to date and is thoroughly reliable.

South America, by Isaiah Bowman. R. M. & Co. 75c.

A second book of the same series also delightfully written. The author describes the country from personal experience acquired in extensive travels.

Readers on Commerce and Industry, by Frank G. Carpenter. A. B. Co.

How the World is Fed, 60c.

How the World is Housed, 60c.

How the World is Clothed. 60c.

The children are taken on tours to the great food centers of the earth, to the factories, the farms, the forests, and the seas. The journeys describe localities, trade routes, transportation, and commerce.

Great American Industries, by W. F. Rocheleau. A. Flannigan & Co., Chicago.

Transportation. 50c.

A valuable reference on roads, inland waterways, and railways giving their history, showing how safety appliances are used, and illustrating many forms of conveyance. The last chapter on aerial navigation tells about the kinds of air craft now in use.

Products of the Soil. 50c.

Cereals, cotton, lumber, sugar, wheat, and fruit.

Manufacturing. 50c.

Minerals. 50c.

Information on minerals is rather difficult to obtain elsewhere in such a simple form.

Industrial Studies—United States, by Nellie B. Allen. Ginn. 65c.

Industrial Studies—Europe, by the same author. 65c.

The suggestions, at the end of each chapter, for further study are a valuable feature.

Stories of Industry, 2 Vol., by Chase and Clow. Ed. Pub. Co. \$1.20.

TEACHERS' REFERENCE BOOKS

The World's Commercial Products, by W. G. Freeman and S. E. Chandler. Ginn. \$2.50.

This is an expensive book but is well worth the money to any school. Its great attraction in addition to its completeness is its twelve beautiful colored plates and its very large number of splendid full-page pictures made from actual photographs.

The World Almanac and Encyclopedia (annual) New York World, N. Y. City. 35c.

Industrial and Commercial Geography, by J. Russell Smith. Holt. \$4.00.

This is a superb work, very complete, covering the whole field and having many fine illustrations, maps, and diagrams.

From Trail to Railway, by Albert P. Brigham. Ginn. 50c.

The author has given an historical account of the great transportation lines which cross the Appalachian Mountains; shows how surface features have determined routes of travel.

Geographical Influences in American History, by Albert P. Brigham. Ginn. \$1.25.

Points out how American history has been influenced by geography.

The Teaching of Geography in Elementary Schools, by Richard E. Dodge and Clara B. Kirchway. R. McN. & Co. 75c.

This is one of the best books that have recently appeared and ought to be read by every teacher of geography in the elementary schools, in order to get the latest views on the teaching of this subject. Extensive references for further reading are given at the end of each chapter.

Principles and Methods of Teaching Geography, by Frederick L. Holtz. Macmillan. 90c.

This is one of the late books on the subject.

Mathematical Geography, by Willis E. Johnson. A. B. Co. \$1.00.

A very valuable reference on any topic in mathematical geography. The explanations are unusually clear and free from technical language.

EQUIPMENT FOR GRAPHIC EXPRESSION

To give children an opportunity to express facts in a graphic way is an important phase of geography. In order to do this some equipment is necessary. The few articles mentioned in this list will make a minimum working outfit to which other things may be added if time and conditions warrant the teacher in doing so.

Outline maps

(a) United States

Station Base maps, Form E. 7 in. x 10 in. Per 100..... .15

Washington Base Maps, Form C. 16 in. x 18 in. Per 100.. .60

These are blank weather maps which show the boundaries of states and the location of all cities having weather observation stations. Their low price makes them available for very general use. Send coin or money order to Chief of the Weather Bureau, Washington, D. C.

(b) Continents of the world

Desk maps, 8 in. x 10 in. Per 100..... .50
Jennings Publishing Co. Box 47, Brooklyn, N. Y.

The simplicity and lack of too much detail make these maps especially valuable.

(c) Countries of Europe and North America

Desk maps, 8 in. x 10 in. Per 100..... .50

McKinley Publishing Co., 1619 Ranstead St., Philadelphia Pa.

(d) Wall Outline Maps of the Continents; European Countries, and Groups of the United States.

Size, 32 x 44, published by the same company. Each..... .20

Coast lines, rivers, boundaries of states, and lines of longitude and latitude are printed on heavy manilla paper. In case school officials will not furnish enough ordinary wall maps the teacher can use these to locate the necessary data.

Desk outline maps are also published by many other companies: Rand, McNally & Co., Chicago; A. J. Nystrom & Co., Chicago; Wm. Beverly Harrison, Broadway, New York; McKnight and McKnight, Normal, Ill.; Chicago Uni. Press, Chicago, Ill.

United States Puzzle Map

Published by J. L. Hammett Co., 250 Devonshire St., Boston, Mass.

A printed paper map, mounted on wood, is cut on state lines. Size 12 in. x 20 in. Children learn the name and shape of the states by fitting them together.

Colored crayons

"Crayola." J. L. Hammett Co., Boston, Mass. Per doz. boxes, 72c

Indispensable for tinting maps to show surface elevations, climatic regions, products, political divisions, and many other features.

Hectograph

Material—Shallow galvanized pan, $\frac{5}{8}$ inch deep

Three oz. of best star or jello glue

One pound of glycerine

Break the glue into small bits, put them into an earthen dish and pour in just enough water to cover the glue. Let it stand 12 hours then place the dish in another vessel of boiling water. When the glue is dissolved add the glycerine. After it has boiled twenty minutes add six drops of oil of cloves or carbolic acid and pour it into the pan gently and slowly to avoid forming bubbles. Before using for the first time wipe the surface with a damp cloth, let it become nearly dry, then lay the "original copy" face down on the surface of the gelatine, rub smoothly into contact, let it stand five minutes, carefully remove it, and at once take the desired number of copies.

A printed outline map may be traced with hectograph ink or copying pencil to make the "original copy."

If the hectograph proves to be too soft or sticky, melt, return to the dish and boil it ten or fifteen minutes longer, add oil of cloves, pour back into the pan, and when it cools try it again.

Twenty-four hours after taking off a set of copies the hectograph may be used again without washing, but if it is to be used a second time immediately, it should be gently washed with a sponge and water. The glue and glycerine may be purchased at a paint store.

An excellent and inexpensive duplicator is the Daus Tip-Top Duplicator, \$5.00. Felix Daus, 111 John St., New York.

ILLUSTRATIVE MATERIAL

Pictures

The teacher and pupils should constantly be on the lookout for large, clear illustrations in magazines and advertisements. The pictures may be cut out and mounted on heavy manilla paper, or cardboard, of uniform size.

Many industrial concerns issue publications and exhibits which illustrate the raw material and processes of producing their commodity. In many instances valuable information is given about the country from which they obtain their supplies. Except in a few cases this material is sent to schools upon the payment of express charges though that is not always required.

Descriptive literature and exhibits of industries

Advertisements in the form of booklets and folders, giving interesting descriptions and beautiful illustrations may be obtained without cost from railroads and steamship lines, chambers of commerce, and real estate brokers. For a large list of such material and the places where it can be obtained see the *Journal of Geography*, Jan. 1914 and Jan. 1915. Published by R. H. Whitbeck, Madison, Wis. The Jan. 1915, issue includes 500 titles and list of 50 educational exhibits obtainable free or at small cost. This number of the magazine is still available. 15 cents.

DEATH OF WILLIAM J. SUTHERLAND

On Thursday, Dec. 9, President William J. Sutherland of the Platteville, Wis., Normal School, dropped dead in his office. President Sutherland was one of the contributing editors of this *Journal*, was president of the Wisconsin Geographical Society, and Wisconsin representative on the National Council of Geography Teachers. He was author of a widely used book on the Teaching of Geography, and joint author of *Practical Exercises in Geography*. At the time of his death he was actively occupied with plans for extending the work of the Wisconsin Geographical Society. He was a fine type of man, interested in everything that would benefit his fellowmen,—an educator whose loss will be keenly felt in Wisconsin.

GEOGRAPHY IN DETRIOT ELEMENTARY SCHOOLS

By Burton A. Barnes

Principal Cary School, Detroit, Mich.

AT the beginning of the school year of 1914-1915, Superintendent Charles E. Chadsey appointed two committees of teachers and principals to revise the course of study in geography in the elementary schools of Detroit. A committee of five worked on the course for the third, fourth and B fifth grades, and another group of five revised the course for the A fifth and sixth grades. The two committees worked together much of the time to insure unity in the result. All the members of both committees also kept in close touch with the work of other teachers and principals in the system, and with the geography in other school systems through courses of study, pamphlets, and letters for which the committee are indebted to school people in various parts of the country.

OUTLINE BY GRADES

Third Grade—B class:

- I. The development of some geographic concepts
- II. Home Geography
 1. Study of a farm

Third grade—A class:

- I. Home geography
 1. Detroit
 2. Wayne County
 3. Michigan

Fourth grade—B class:

- I. The earth as a whole
- II. North America as a whole
- III. The United States (New England States, Middle Atlantic States)

Fourth Grade—A class:

- I. The United States (Southern States, North Central States, Plateau States, Pacific States)

Fifth grade—B class:

- I. Europe
- II. Canada

Fifth grade—A class:

- I. South America
 - II. Mexico
 - III. Panama Canal
 - IV. Africa
 - V. Australia
- 

Sixth grade—B class:

- I. Asia
- II. Islands of the Pacific
- III. Europe (Southern Europe and Russia)

Sixth grade—A class:

- I. Europe (Northern Europe, omitting Russia)
- II. The United States

It will be noted that, as yet, no new work in geography has been provided above the A class, sixth grade. Formerly the course extended through the B seventh. The change was made because the Junior High Schools are being rapidly opened in Detroit, and the promotion into the Junior High comes at the end of the sixth. It is probable that within the next two years a more advanced course in industrial and commercial geography will be provided to follow the work outlined in this course of study.

The introduction to the new course of study is a manual of methods of teaching geography as they have been evolved in Detroit. The following quotation from the first page of the introduction gives in brief what is enlarged upon in the next twelve pages of the book.

"In the study of geography there are two things to understand:

I. MAPS

II. RELATIONS BETWEEN NATURAL CONTROLS AND LIFE RESPONSES

In the school-room, the study of maps and of relations between controls and responses, is carried on by drilling, by gathering material on topics, and by solving problems. An analysis of these three activities as participated in by groups of children studying geography shows certain powers, skills, habits which a pupil should develop. These powers, skills, habits are the specific results which are to be used as aims by teachers and pupils. In learning, then, to understand maps and relations between natural controls and life responses, the pupil should:

1. Visualize maps, and locate the points listed under "Minimum Essentials in Location"
2. Gather geographical material
3. Organize geographical material
4. Acquire general information
5. Discover problems
6. Solve problems
7. Study pictures
8. Read books of travel, travel articles in magazines, and geographical material in newspapers
9. Observe geographical phenomena in the neighborhood

10. Co-operate with others by making reports to the class, or by serving on committees to investigate and report."

From the above quotation it will be seen that an attempt has been made in the course to state specific aims in the teaching of geography. It is realized that this attempt does not result in anything very definite, but each aim is discussed at some length in the introduction, with the hope that in time, teachers will be able to analyze each aim and determine exactly what powers, skills, habits are to be cultivated, and to what degree each is to be cultivated. In other words, the course of study is so arranged and worded that if definition of aim and limitation of training, as advocated by the measurement men, are to be realized in geography teaching, they may grow from the point of view of this course. It may be that the advance in geography teaching in the next ten years will be brought about through this aim-analysis and the establishment of standards and tests. If so, we are prepared; if not, we at least have an aid to the present day teacher.

In attaining these aims, the teacher is encouraged to conduct the recitation, as far as possible, as a discussion with a purpose, rather than as a drill. The recitation is considered as an opportunity for the teacher to aid the pupils in learning how to study. Co-operative work by committees of pupils who prepare reports to the class on various subjects is emphasized in the fifth and sixth grades. In fact, every effort is made to make the recitation a life activity. In this regard, however, the committee were working under a limitation imposed upon all course-of-study makers at the present stage of progress of teaching in the schools. There is only one activity to participate in, and that is sitting around and discussing things. It is to be hoped that more methods with manual features will evolve in the near future.

With this purpose in view,—making the geography recitation a discussion,—the bulk of the material in the course is arranged in the form of topics to be discussed in class by teachers and pupils, or of problems to be solved. The topics extend all the way through the course. The problems begin in the A fifth. Following each topic and each problem are references to books found in the school building, and also to other books found in the branch public libraries. In preparing these library references a committee from the library worked in co-operation with the geography committee. Each librarian has a copy of the course, so that when a child comes to the library looking for material in geography the librarian knows what he wants and why he wants it.

The following quotations from the course of study will best explain the method of treatment of the topic and of the problem:

"A topic in elementary geography is usually a description of life responses with some attention to causes. In the lower grades the life side is to be emphasized, but in the upper grades the underlying natural causes of life conditions described should often be emphasized."

"A problem in geography is a question the answer to which expresses causal relation between natural controls and life responses."

A TYPICAL TOPIC. (THIRD GRADE—B CLASS)

Wheat-raising:

Study the production of wheat from the preparation of the soil to its consumption as food.

- (a) Plowing
- (b) Harrowing
- (c) Sowing—seed drills
- (d) Harvesting
 - 1. Reaping
 - 2. Threshing
 - (a) Grain shipped to mill
 - (b) Straw used for bedding stock
- (e) Transportation
 - 1. How? (a) Wagon; (b) Rail; (c) Water.
 - 2. Where? (a) To store; (b) To our homes.

Suggestion: Pictures of farming implements may be used to advantage.

- (f) Field Work (optional)
 - 1. Examine a garden in preparation for planting
 - 2. A visit to a flour mill
 - 3. A visit to a grocery store
 - 4. A visit to a market

- (g) Stereopticon Lesson on Wheat

See literature slides for social side of farming.

References—Tarr & McMurry, Book I, pages 67-75

Winslow, Book I, pages 2-3, 58-63, 9-13, 44-45

Winslow, Book II, page 134

Carpenter's North America, Chapter XXII

Stories of Country Life, pages 14-17, 26-27, 72-77, 82-88, 89-95

How We Are Fed, pages 7-17

Agriculture for Beginners, pages 216-217, 163-167

A TYPICAL PROBLEM (SIXTH GRADE—A CLASS)

"Give reasons for the commercial and industrial growth of England."

- 1. Position. Middle of the land hemisphere. See globe and map of the world.
- 2. Character of the people. Noted for their energy and intelligence. Skilled workmen.
- 3. Coastline irregular. Many fine, deep harbors. See map.
- 4. Climate. Westerly winds cause a mild, damp climate favorable to

- the manufacture of cotton. See climate maps. Harbors open all the year.
5. Surface. Mostly low plain. Railroads and canals easily built. See physical map.
 6. Mineral products. Coal, iron, limestone near each other and near the sea. See map of the distribution of minerals.
 7. Raw material. Easy to obtain.
 8. Smallness of country. Factory near coal fields and near shipping point.
 9. Ready market. Colonies.
 10. Fisheries.

References—Dodge, pages 226, 227, 229, 230

Tarr, pages 263-270

Carpenter, pages 57-64

Winslow, Book IV, pages 18-24

Brigham, pages 87, 303

Library References—Allen, Industrial Studies, Europe, page 73

Adams, Commercial Geography, page 195

Redway, Commercial Geography, pages 296, 297

MINIMUM ESSENTIALS

To provide for elasticity in the course, because it is to be used with classes of children under varying conditions in a large city, the most important topics and problems are starred. These starred topics and problems are the minimum essentials in content work.

The last course of study in Detroit put considerable emphasis on type studies. Previously there had been too much emphasis on map study. As a result of the emphasis on type studies the teaching had swung away from map work too far, and pupils were found surprisingly weak in the location of cities like New York or Chicago. To offset this tendency of careless content work to absorb all the time of classes, a list of minimum essentials in location was prepared. Each point of location was carefully discussed by the committee before it was placed in the list. The question asked was, "Has this place any direct relation to us here in Detroit?" A place once put in the list is repeated in all succeeding classes, so that the list for the sixth grade—A class—contains all the minimum essentials of the course.

SIXTH GRADE—A CLASS—MINIMUM ESSENTIALS IN LOCATION

Pupils should be able to locate on an unlettered map the points listed below:

North America, South America, Europe, Asia, Africa, Australia.

Atlantic Ocean, Pacific Ocean, Arctic Ocean, Antarctic Ocean, Indian Ocean.

United States, Canada, Mexico, Central America.

All of the states of the Union, Alaska, District of Columbia, and Cuba.

Gulf of St. Lawrence, Gulf of Mexico, San Francisco Bay, Puget Sound, Chesapeake Bay, Hudson Bay.

Rocky Mts., Appalachian Mts., Pike's Peak, Mt. Washington, Adirondack Mts.

Detroit River, St. Lawrence River, Mississippi River, Columbia River, Ohio River, Missouri River, the Rio Grande, Colorado River, Hudson River, Soo Canal, Erie Canal, Panama Canal, Niagara Falls.

Lake Superior, Lake Michigan, Lake Huron, Lake St. Clair, Lake Erie, Lake Ontario, Lake Champlain.

Yellowstone Park, Yosemite Park, Grand Canyon.

Detroit, Boston, New York, Philadelphia, Pittsburg, Washington, New Orleans, Galveston, Chicago, St. Louis, Cleveland, Buffalo, Cincinnati, Minneapolis, St. Paul, Duluth, Denver, Salt Lake City, San Francisco, Seattle, Los Angeles, Baltimore, Havana.

Lansing, Jackson, Pontiac, Port Huron, Ypsilanti, Ann Arbor, Mt. Clemens, Monroe, Grand Rapids, Kalamazoo, Alpena, Traverse City, Sault Ste. Marie, Escanaba, Marquette, Houghton, Ironwood, Saginaw, Bay City.

Toronto, Montreal, Quebec, Winnipeg, Vancouver.

Buenos Aires, Rio de Janeiro, Valparaiso, Andes Mts., Amazon River, Orinoco River, Cape Horn, Argentina, Brazil, Chile, Colombia.

Suez Canal, Strait of Gibraltar, Mediterranean Sea, Red Sea, Egypt, the Sahara, St. Helena, Cape of Good Hope, Cape Town, Alexandria, Cairo, Nile River, Niger River, Congo River, Zambezi River.

Canberra, Sydney, Melbourne, Hawaiian Islands, East Indies, The Philippines, New Zealand.

Japan, China, India, Siberia, Caspian Sea, Dead Sea, Himalaya Mts., Mt. Everest, Peking, Bombay, Calcutta, Tokio, Yokohama, Hong Kong, Vladivostok, Manila, Honolulu, Jerusalem, Yangste River, Hoang Ho, Ganges River, Euphrates River.

Austria-Hungary, Belgium, England, Ireland, Denmark, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Russia, Scotland, Spain, Sweden, Switzerland, Turkey, Wales, Balkan Peninsula.

Liverpool, London, Glasgow, Edinburgh, Dublin, Belfast, The Hague, Brussels, Paris, Havre, Lyons, Rome, Venice, Florence, Genoa, Athens, Constantinople, Vienna, Geneva, Berlin, Hamburg, Bremen, Cologne, Petrograd, Warsaw, Moscow, Odessa, Madrid.

North Sea, Baltic Sea, Black Sea, Adriatic Sea, English Channel, Dardanelles.

Thames River, Rhine River, Seine River, Danube River, Volga River, Alps Mts., Mt. Blanc, Mt. Vesuvius.

Material for a Detroit Day is provided in each of the upper grades, and comparisons with home conditions are often suggested. In respect to local

geography, however, the course shares the weakness of present American courses of study. We have no text-book which properly emphasizes Detroit and Michigan. All the references must be made to books which are printed to sell in all sections of the country, and no matter what may be said about courses of study determining the character of the text-books rather than the text-books determining the character of the course of study, the truth remains that when you are making a course of study you are shackled by the books. Each city should have its own text-book written from its own view-point, because the view-point of the community is a large part of the geography of that community. This is one of the big steps in advance which geography teaching in this country must make in the future.

THE MAKING OF A GREAT MODERN HARBOR—LIVERPOOL

By K. W. Davidson
Oshkosh, Wis.

The belief is quite common among adults, and particularly prevalent among pupils, that the great harbors of the world are nature-made; that man has only to use them practically as he finds them. Few people realized that even an excellent natural harbor usually requires millions of dollars of outlay to fit it for the demands of modern commerce. From 50 to 200 million dollars have been expended on the improvement of many of the great European harbors. The following paper gives an account of the methods by which Liverpool's two hundred million dollar harbor has been brought to its present high efficiency.—Editor.

UP to the end of the eighteenth century the port of Liverpool had been improved but little. The harbor was shallow; the warehouses, dry docks, and freight docks were few in number, poor in construction, and entirely inadequate. It was out of the question for private individuals to assume the task of extensive improvements, and corporations had not reached their present commanding position. It became necessary, therefore, for the city to improve the harbor as a regular municipal duty. A few docks were built and trade was drawn in, which not only paid the interest on the sum invested and the cost of maintenance, but left a large surplus. Out of the disposal of this surplus—it was used in the end to build St. George's Hall—grew a series of disputes which were aggravated by the Manchester merchants.

The final result of the disputes was the passage of a Parliamentary Act in 1857 which created the Mersey Dock and Harbor board. To this board was given the complete control of the docks and harbor of Liverpool. It was incorporated, like any corporation, with the power to hold property and transact business, including the right to raise money by the issue of bonds. This organization is composed of twenty-eight members, four of whom are appointed by the national government, while the other twenty-four are elected

by those citizens of Liverpool who pay dock rates. Its authority includes the absolute control of all dock dues, rates, and fees, harbor lights, dredging, and all dock improvements. The Board serves without pay, and membership on it is considered one of the greatest honors which can be conferred upon a Liverpool business man.

When this Board took control of the affairs of Liverpool harbor it faced four obstacles to further commercial development. (1) The estuary of the Mersey River, upon which Liverpool is situated, was filled with changing currents which deposited bars in the harbor and the Great Bar at the mouth of the Mersey.

(2) The graving dockage was limited and in poor condition.

(3) The warehouses were flimsy structures and were totally inadequate.

(4) The tide rose and fell in the harbor to the extent of thirty feet.

The first defect has continued to be, in spite of careful and scientific dredging, a great check to the use of the river at all tides. At present, however, the Board maintains a thirty-five foot channel across the Great Bar, which allows the largest vessels to cross for several hours before and after flood tide. Since 1889 the Board has kept a powerful fleet of dredges almost constantly at work removing the shifting sands. In 1909 the Board had built at an expense of \$750,000, a twin screw, self-propelling dredge capable of filling itself with 10,000 tons of sand in one hour. This dredge alone removed more than 10,000,000 tons during the year 1912. In addition to this boat the Board maintains four other powerful dredges. During the fiscal year ending July 1, 1912, more than 16,500,000 tons of sand were removed.

The Dock and Harbor Board handled its problem of limited and inadequate graving dockage in the same comprehensive manner in which it handled the shifting sands. Today the Board controls sixteen strictly modern graving docks.

The Board's third problem, that of inadequate freight accommodation, has been handled in an equally efficient manner. The great warehouses in connection with all the docks are now equal to the demands of Liverpool's commerce, and are fitted with the most modern handling machinery. For instance, the tobacco warehouse at the Stanley Dock is claimed to be the largest warehouse in the world,—723 feet in length, 165 feet wide, and thirteen stories high, with a floor area of thirty-six acres and a capacity of 66,000 hogsheads. It is lighted throughout by electricity and is supplied with all the latest devices for handling cargo. The wool warehouse has an actual storage capacity of 100,000 bales. The cattle trade is mainly handled at the Birkenhead docks, where the facilities for caring for dressed meat, as well as for live cattle are claimed to be the finest in the world.

The masterpiece of the Dock and Harbor Board, however, is its work in dealing with the problem which was raised by the thirty foot tide,—that of passenger and freight dockage. The tide brought into use a unique system

of docks for the loading and unloading of vessels. There are two distinct types of docks: one is used for the passenger liners, and the other by the freight boats. For the discharge of passengers the liners use floating landing stages. The largest stage, Prince's Landing, which was built in 1907, is 2463 feet in length. It is supported by iron pontoons, held in position by eight hinged bridges connected with the mainland.

In order to realize what a great part the improvement in the freight docks has played in Liverpool's commercial growth, one must first have an idea of the great problem of the tide. It was not altogether a question of water depth. It was obviously unsafe to allow a vessel to rest upon the bottom twice a day at low tide without support. Yet, even if a sufficient depth of water was maintained, the fact that a vessel rose and fell thirty feet twice a day would greatly interfere with loading and unloading.

The solution of the problem was the invention of an obscure Liverpool engineer, who, more than a century ago, drew the first plan of the tide docks. These docks are built on the principle of our locks. When a ship enters one of the docks at flood tide, gates are closed behind it and thus, by means of the constant water-level which the gates maintain, practically all the advantages of a tideless harbor are obtained. When the ship is ready to leave her dock, the water-level is lowered to that of the outside harbor. In this way the loading and unloading of ships is greatly facilitated.

As in the cases of dredging and graving dockage, the Board has made very extensive improvements in the freight docks. At present it controls 28 docks whose water area is 560 acres, and whose quayage is 27 miles, representing an outlay of approximately \$200,000,000. In 1907 under permission of Parliament, the Board began the construction of the largest of the wet docks. This is of such size as to accommodate four ships with lengths up to 1100 feet and of 120-foot beam. The cost was \$16,000,000; its gates alone costing \$8,000,000. The Board started work on the Gladstone Dock in 1908, authorizing for its construction about \$25,000,000.

At present the Board has supervision over the entire harbor of Liverpool, which includes the docks on the Birkenhead side of the harbor. This great harbor has a water area of 4090 acres, and an average mid-stream depth of 40 feet. In 1913 it handled exports and imports amounting to the enormous sum of 2,000 million dollars.

Through its far sighted policy and improvements the Dock and Harbor Board has raised Liverpool to the position of the fourth world port in the value of commerce. Starting with a shallow, bar-filled harbor the Board has produced a harbor that will easily float the largest vessels. Given a few poorly equipped docks and warehouses it has produced model harbor facilities. It has given to the harbor a set of docks and warehouses of the most durable construction,—docks and quay walls of masonry or concrete; sheds and warehouses of steel, stone, or brick,—and has connected the whole system of docks and warehouses with the national railways by an eighty-mile electric

railway. The land area of the Dock Estate has been increased from a few small holdings to 1,677 acres. The general receipts of the Board from the docks reach nearly \$10,000,000 a year. Through this method of improvement and management the Mersey Dock and Harbor Board has in 56 years raised Liverpool to one of the great world ports, a port which always keeps a few years ahead of the demands of commerce both in size and capacity of accommodations.

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Annual Statement of Navigation in the United Kingdom.

BALKAN PEOPLES

IN a new book, entitled *Geographical Aspects of Balkan Problems*, Marion I. Newbigin, editor of the Scottish Geographical Magazine, discusses the racial characteristics of the Balkan peoples. The following paragraphs are excerpts from the book, though, in most cases considerably abridged.

Balkan Peoples.—Apart from the representatives of alien peoples, of which the Armenians and the Jews are the most numerous, there are in the peninsula no less than six separate races. These are the Albanians; the Vlachs, or nomad shepherds—usually regarded as at least nearly akin to the Roumanians; the Greeks; the Serbs; the Bulgars; and the Osmanli Turks. In some parts of the peninsula, notably in Macedonia, all six races are represented.

Albanians.—It is exceedingly difficult to make a nation out of a people whose chief amusement is to shoot their own brethren, members of rival clans, at sight. The game, which is conducted according to very strict rules, is undoubtedly one of a most thrilling nature—far superior, one would imagine, to fox-hunting in excitement; but it scarcely conduces either to social stability or to social development, and one can hardly blame the Serbs for feeling that it is unreasonable that they should be shut out from the Adriatic in order to provide the Albanians with extensive man-hunting coverts. There is, further, no evidence that the Albanians want to be a nation, while one would suppose that with judicious treatment they might well, like the Highlanders of Scotland, become useful elements in another nation.

The Albanians are generally engaged in the pastoral industry, sheep and goats, as was to be expected under the physical and economic conditions, predominating. The general insecurity and the difficulty of communication makes trade insignificant, and the demands of the people are small.

As there is little government, and justice is confined to the rough method of the blood feud, the family tie is necessarily strong, and the family—in the patriarchal sense, occupies a fortified dwelling, perpetually prepared for a siege.

The Vlachs.—The Vlachs are—or were—nomad shepherds, having temporary homes both in the mountains, where they pass the warmer period, and in the plains, coastal or interior, where they spend the winter. The Vlachs who keep this primitive nomadism own no mountain-pastures of their own, and the increasing rents are a great obstacle to their prosperity. The result is that they tend more and more to lose their characteristic nomadism, and settle down in villages.

The Serbs.—Serbia is an agricultural and pastoral country, whose people are predominantly, though to a decreasing extent engaged on the land. Owing to the marked subdivision of the land, there is no pauperism, though there is little wealth. All the attributes of a democratic agricultural community appear.

Serbia's ambitions in the direction of the Adriatic were frustrated by the Powers, who insisted upon the erection of an independent Albania, and thus concentrated the aspirations of Serbia, Bulgaria, and Greece alike on the north-western corner of the Aegean. This led, naturally enough, to quarrels among the three larger Balkan States, and while Serbia and Greece agreed to adjust the questions at issue between them, their settlement was to some extent at the expense of Bulgaria, whose disappointment led her into the short, and to her disastrous, campaign of 1913.

Among Serbia's important markets for her livestock are Naples and Genoa. She wants, and wants intensely, to increase her trade with Italy, to follow a line of development which would diminish risk of friction either with Greece or with Bulgaria.

The Greeks.—The Greeks have a glorious literary tradition, and a rich language, with a single alphabet. There are several Albanian alphabets. Further, their commercial relations make their language of importance outside the limits of their own race, a marked contrast to the Albanians, among whom the dialect of the northern groups does not even suffice for communication with the southern ones, and is useless for wider purposes. The sinking of the old Aegean continent has given to Greece that facility of communication which is denied to the other States. Her destiny lies upon the sea, for it is the sea which has made her possible and therefore her demand is ever for more and more coast-line.

The Turks.—To the geographer the expulsion of the Turk from the peninsula can be justified on the ground that he has failed to utilize the land which he has held so long, and on this ground alone. He has been within the peninsula a parasite, chiefly upon the ploughing peasant, and the effect has

been to implant in the mind of that peasant a passion for agriculture, for the undisturbed possession of a patch of freehold, which is probably as strong here as it has ever been in the world.

SUGAR BEET CULTURE AND HOW BEET-SUGAR IS MADE

The fields to be planted to sugar beets are first thoroughly fertilized. The land is plowed about ten inches deep in the fall if possible. Sugar beets require deeper plowing than most crops. In the spring the ground is harrowed, and the beet seed is then drilled in rows eighteen inches apart, twenty pounds of seed being drilled to each acre. The beet seed is obtained by the factory from Germany and Austria, and sold to the farmers at cost, usually ten cents per pound. When the beets are up and show the third or fourth leaf they are "thinned," leaving one beet in a place eight inches apart. The leaves of the beets gather the sugar from the atmosphere by the aid of the light and deposit the sugar in the root, none of it coming from the soil; hence the fields are kept clear of weeds and foul growth, which would shade the beets and reduce their sugar content. Most fields are cultivated several times during the season and hoed by hand at least twice. The beets usually begin to ripen about the first of September, and samples are taken every week by the factory to determine when the beets are ready to be pulled. When the beets are ripe as determined by the tests, i. e., when the percentage of sugar is high enough, the beets are plowed up.

Two factors are considered before the factory instructs the farmer to plow up his beets, first, the per cent of sugar in the beet; second, the purity of the beet. By the purity is meant the amount of sugar in the beet as compared with the total amount of salts present. Contained in the beet are substances in solution other than sugar, as porteiins, nitrogenous matters, etc. It is the presence of these substances that makes sugar extraction expensive. They also decrease the amount of sugar that can be extracted, as these impurities must not pass into the sugar. Beets must have at least an 80 per cent purity to be fit for sugar making. After the beets are plowed out the tops are cut off just below the crown of the beet, so as to remove any portion which grew above the ground as such portion of the beet contains but a very small percentage of sugar. This is the first and only time the beets or their product are touched by human hands until after the sack of sugar has been opened at the place of consumption. Samples are taken by the factory from each wagon load of beets delivered by the farmers, and conveyed to the beet laboratory, where it is tested for its sugar content and purity. The farmers receive fifty cents per ton additional for all beets testing over sixteen per cent in sugar.

The beets are stored at the factory in four long sheds, from which they are flumed into the factory as needed. They are given a thorough washing before being sliced.

From the weighing scale the beets pass to the slicers where with trian-

lar knives they are cut into long slender slices which look something like "shoestring" potatoes. These slices drop through a chute into a series of cylindrical vessels. After passing through the entire series of vessels, the water has become rich in sugar, of which it contains from twelve to fifteen per cent, depending upon the richness of the beets. The juice is then drawn off and is called diffusion or raw juice. The beet pulp is pumped out of the factory into bins, from which it is fed to stock as wet pulp. The warm raw juice drawn from the diffusion battery is then pumped into the carbonation tanks and treated with about ten per cent milk of lime. From the carbonation tanks the juice is forced through filter presses and is again treated with carbonic acid gas, again filtered, and passes to the evaporators, large air-tight vessels in which the juice is boiled out at a low temperature in a partial vacuum.

After considerable thickening by this evaporation minute crystals begin to form. The mass of crystals from the vacuum pans with syrup around them is let out of the pans into a large open vessel, beneath which are the centrifugal machines. Centrifugal force drives the syrup out through the screen holes leaving the white crystals of sugar in a thick layer on the inner surface. Warm dry air is drawn through and takes the moisture out of the sugar, which is now ready to be put into bags.

CATTLE IN INDIA AND ITALY

The place of cattle in connection with agriculture is very different in India from that which it occupies in European countries. On the other hand, bullocks are universally used for all operations for which horses or machinery are used in Europe, and the cow and her various products are held in superstitious esteem everywhere except on the northeastern frontier. Beef, however, is rejected as food absolutely by Hindoos and largely by Mohammedans out of sympathy, with the result that breeding, grazing, fodder crops and even dairying are generally neglected. Working bullocks are fed somehow, but cows are left to pick up what they can, and useless animals are allowed to compete for the scattered food available in the hot season. Buffaloes are everywhere in demand for their milk, which is richer than that of cows. It is only in the marshy tracts that they are used for agriculture. No sanctity attaches to the buffalo.—From the Oxford Survey of the British Empire, Volume 2.

The Italian dairy industry depends chiefly on sheep and cattle. The scarcity of cattle, which is more important in milk production, is quite evident both in actual number and in number relative to the population, when compared with various other European countries. More than half the total number of dairy cows are found in the valley of the Po. Of these over one-fourth are found in Lombardy, where the density of cattle is greatest. Lower Lombardy, which includes fertile irrigated plains, is the zone of most intensive milk production. Owing to irrigation, four crops of hay may be obtained

annually and on certain fields near Milan and Pavia, the number rises to 7 or 8. The quadrangle bounded by the rivers Ticino, Po, and Adda, and the parallel running through Milan, is characterized by its dairy farming, the milk production per unit area or per capita being higher than in any other part of the world.

Sheep are most abundant in the southern Adriatic region. In a general way it may be said that the number of cattle per acre decreases going from north to south, while the number of sheep per acre increases. Goats also abound in the southern Adriatic region.

Even the most modern and up-to-date dairies of Italy are very modest when compared with the large establishments of other countries. About five-sixths of the total milk production of Italy is turned into cheese, butter, and their by-products. Among the most famous of Italian cheeses are Stracchino, Gorgonzola, and Grana. Stracchino and Gorgonzola cheese are produced chiefly in Lombardy. Certain less well known cheeses are made from sheep's milk.—From the Monthly Bulletin of Agricultural Intelligence and Plant Diseases, July, 1914.

NEWS NOTES

THE Geography section of the Central Association of Science and Mathematics Teachers met in Chicago, November 26 and 27. Following is the program:

Geography as a Preparation for Citizenship, R. H. Whitbeck, University of Wisconsin.

Economic Importance of Glaciation, Wm. H. Haas, Northwestern University.

When the Coal is Gone, What then? (Illust.), J. Paule Goode, University of Chicago.

Symposium, Economy in the Teaching of Geography in the High School—

1. Follow-up of the Work in the Grades, Miss Zonia Baber, University of Chicago.

2. Physiography and Commercial Geography, Miss A. E. Aitchison, Iowa State Teachers College.

3. Laboratory and Recitation, Miss H. Jennings, Shortridge H. S., Indiana.

4. Double Periods, J. M. Larke, Joliet Township High School.

5. Trip Around the World on the 40th Parallel, D. C. Ridgley, Ill. State Normal University.

Committee Report—Present Status of Physiography, C. E. Peet, Lewis Institute, Chicago.

General Science in the First Year, J. C. Hessler, Milliken University.

Reactions of First Year Students to General Science,

Miss Frances Abbot, Springfield, Ill.

Miss Ellen T. Sullivan, La Grange, Ill.

Miss Meta Mannhardt, Evanston, Ill.

The February number of the Journal of Geography will be a special MINNESOTA NUMBER, prepared by Professor C. J. Posey of the University of Minnesota, and a corps of teachers, geographers, and others. It will be double the usual size of the magazine and will be a highly valuable collection of papers on Minnesota geography. Single copies, 15 cents; 6 copies, 70 cents; 10 or more copies to one address, 10 cents each. Send advance orders early, as the edition will be practically limited to the regular issue plus advance orders. See announcement in advertising section of this magazine.

GEOGRAPHICAL ORGANIZATIONS CONTINUE TO INCREASE

THE NORTH DAKOTA COUNCIL OF GEOGRAPHY TEACHERS

A meeting of the teachers of geography was held during the recent session of the North Dakota Educational Association to consider plans for the betterment of the teaching of geography and for the encouragement of the study of the North Dakota field. Much interest was shown in the plan for a National Council of Geography Teachers, and a state council for North Dakota was organized among those joining the national organization. The following officers are chosen for the initial year: President, Howard E. Simpson, University, North Dakota; Vice-president, Miss Lura Perrine, Valley City State Normal; Secretary-treasurer, Miss Huldah Winsted, Minot State Normal School. Annual meetings will be held in affiliation with the State Educational Association, and an invitation is extended to all teachers of geography and to all others especially interested in this subject who live in North Dakota to communicate with the officers and to affiliate themselves with the council.

HOWARD E. SIMPSON.

ILLINOIS COUNCIL OF GEOGRAPHY TEACHERS

In July, 1914, a group of geographers, who attended the science section of the National Education Association at St. Paul, planned for the organization of a National Council of Geography Teachers. This plan received the cordial approval of the Association of American Geographers at their annual meeting in Chicago in December, 1914. The inaugurating committee of the National Council proposed the formation of State Councils of Geography Teachers to bring the many teachers of geography throughout the states into closer touch with the movement. Miss Mabel C. Stark, of the Illinois State Normal University at Normal, Illinois, has been appointed leader of the movement for Illinois.

The cause of the State Council was presented by the chairman at the Geography Section of the High School Conference held at the University of Illinois, November 19 and 20, and also at the Earth Science Section of the Central Association of Science and Mathematics Teachers in Chicago, November 26 and 27. The geographers present at these meetings gave hearty support to the movement.

The National Council has a yearly membership fee of \$1, which includes subscription to the *Journal of Geography*, the official organ of the council. It has been suggested that for the present at least members of the Illinois Council of Geography Teachers be given a chance to become (1) just members of the State Council at a yearly fee of 25 cents, or (2) both State and National Council members at a fee of \$1.25, including subscription to the *Journal of Geography*.

Your name and fee, either for membership in the State Council or for State plus National membership, may be sent for the present to the chairman of the State Council.

Your suggestions and enthusiastic co-operation in this movement for a "bigger and better geography" are earnestly invited.

MABEL C. STARK.

THE SOUTHERN GEOGRAPHIC SOCIETY

Plans for the extension of the work of the Southern Geographic society were discussed at a meeting of the board of directors of the society recently in Knoxville. Dr. C. H. Gordon, of the University of Tennessee, president, presided over the meeting, which was an enthusiastic one.

Arrangements have been practically completed for the organization of a branch of the society in Nashville. Efforts will also be made to form societies in Chattanooga, Memphis, Atlanta, New Orleans, Birmingham and other southern cities.

The directors also discussed the course of lectures and visatures to be given at Market Hall during the winter months. The first visature will present views of the Yellowstone National park, and the lecture will be delivered by Dr. Gordon.

It is expected that the first of the lectures will be given early in January.

THE VIRGINIA GEOGRAPHIC SOCIETY

Miss Louie C. Kelley of the John Marshall High School, Richmond, Va., president of the society writes: "Virginia has a Geographic Society and hopes to do some good work this year." Mr. E. E. Smith is secretary.

MISSOURI ORGANIZES

Editor of the *Journal of Geography*:

I was interested to note in the last issue of the *Journal of Geography* that organizations of geography teachers had been perfected recently in several states. Lest you think Missouri is unprogressive I hasten to inform you that the Executive Committee of the Missouri State Teachers Association at the last meeting in Kansas City saw fit to grant the request of several of the geography teachers of the state to recognize a distinct department of geography as part of the State Teachers Association.

Our petition making the request was signed by a large number of teachers, including professors Marston of the Springfield Normal; Lewis Thomas of Drury College; Phillips of Warrensburg Normal; Cauffield of Marysville Normal, and Roberts of Cape Girardeau Normal. An organization has been effected and A. E. Parkins was elected chairman and C. E. Marston of Springfield was elected secretary.

The Program Committee is now at work on a program for next year. Everything looks forward to a successful campaign to better the teaching of geography in Missouri. The editor of the Missouri School Journal has offered his paper as a medium for the dissemination of information connected with the affairs of the department.

A. E. PARKINS.

RECENT PUBLICATIONS

TEXT-BOOK OF GEOLOGY.

Part I—Physical Geology, by L. V. Pirsson, vii+444 pages, 6x9; folding colored map. Cloth, \$2.25 net.

Part II—Historical Geology, by Charles Schuchert, viii+622 pages; folding colored map. Cloth, \$2.75 net.

Complete in one volume, x+1051 pages. \$4.00 net.

John Wiley & Sons, 432 Fourth Ave., New York.

The authors of the Text-Book of Geology have for several years been giving an introductory course in geology. Such a course has to meet the needs of students of other sciences, and at the same time be a foundation for those students who wish to continue studying in geology.

In the first part of the book the author presents the facts and principles of physical geology in a most logical and scientific manner. There is little in it that is new for a geologist, but the excellent organization and manner of presentation make the book easy to read and understand. The maps, figures, and pictures are special features which will help the new student of geology.

Historical geology is usually difficult for the beginning student. This is true because the student often lacks training in zoology and botany. The author has learned this by experience and "The attempt has been made," with success, "to meet these difficulties . . . by the introduction of special chapters and appropriately added matter in zoology, botany, processes of evolution, etc., designed to supply the student with the general knowledge needed as a basis for the proper appreciation of the paleontological part, and by a choice of details which are typical rather than a synopsis of the whole field. Also, the introduction of some matter relating to the history of geology as a science, and of its founders, gives the student the proper historical perspective."

M. K. D.

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THE PHYSICAL GEOGRAPHY OF MINNESOTA

By A. Walfred Johnston
University of Minnesota

GENERAL GEOGRAPHY

LOCATION and area. Minnesota is located approximately at the exact geographical center of North America. It is on the northern boundary of the United States, lying equally distant from Vancouver Island and from Nova Scotia, and half way between the Beaufort Sea and the Caribbean Sea. The part of Minnesota lying north of the 49th parallel in the northwest corner of the Lake of the Woods, which comprises an area of about 150 square miles, is the most northern portion of the United States, excepting Alaska.

The area of Minnesota is 84,682 square miles, including 80,858 square miles of land surface and 3,824 square miles of water surface. This does not include the area of 2,514 square miles of Lake Superior adjoining and within the political boundaries of Minnesota. Its greatest length from the northernmost point in the Lake of the Woods to the Iowa boundary is 408 miles, its greatest width, from St. Vincent to Pigeon Point, is 357 miles.

Geology. The rocks of a large area of Minnesota belong to the oldest formations, the pre-Cambrian, and form the southwest margin of the pre-Cambrian shield of North America. A smaller area, the southeastern part of the state, includes rocks of later formation, the Paleozoic and still younger rocks, the Mesozoic, occur over the western part of the state. These formations, over the greater part of the state, are covered by unconsolidated surface deposits made by the weathering of older rocks, by wind, stream, and wave deposition, and by the continental ice sheet.

The pre-Cambrian areas of Minnesota are made up of igneous and sedimentary rocks and their metamorphosed equivalents. The lavas of Pine and Chisago counties, of the north shore of Lake Superior, and of other areas of northeastern Minnesota; the large masses of intrusive granites, gabbros, etc., in the pre-Cambrian area, are igneous rocks, formed by the cooling of molten material. Some of the slates, the ferruginous cherts, the quartzites of central and northeastern Minnesota, the quartzite of New Ulm, of Watonwan, Cot-

tonwood, Pipestone, and Rock counties are metamorphic rocks, derived from muds, shales, and sandstones. The gneisses and schists of central and north-eastern Minnesota and of the Minnesota Valley are also metamorphic rocks. These were made by the alteration of both igneous and sedimentary rocks.

The Paleozoic and Mesozoic areas are made up of sedimentary rocks, limestones, shales, sandstones, and conglomerate.

In general the pre-Cambrian rocks have suffered great changes by folding, faulting, fissuring, and by recrystallization. In some of them the original mineral constituents have been altered and new ones have been developed. The Paleozoic and Mesozoic rocks have been altered very little since their deposition; locally they are folded or gently tilted.

Geological History. The geological events of Minnesota which have a close bearing on its physiography can be summarized as follows: (1) a pre-Cambrian period of deposition of sedimentary rocks and extensive igneous extrusion and intrusion; (2) a period when all the Minnesota area was mountainous, resulting from the folding of the pre-Cambrian rocks; (3) the reduction of the area to a peneplain; (4) the submergence of the greater portion of the area beneath the ocean and deposition of the Paleozoic sediments. These events were not without interruptions and there were oscillations of the sea level during the Paleozoic. (5) A period when the Minnesota area was dry land and denudation was active; during the period the greater portion was reduced to a peneplain; (6) submergence of part of the area beneath the ocean and the deposition of the Cretaceous sediments; (7) a period when Minnesota was dry land, and was being sculptured to something like its present form; (8) a glacial period during which the entire area, except the extreme southeast corner of the state, was buried beneath an ice sheet; (9) a brief post-glacial period.

TOPOGRAPHY

Minnesota is a great undulating plain. The larger part of it lies between 1000 and 1500 feet above sea level. The average altitude of the state is about 1200 feet. The greatest altitude, 2230 feet, is found in one of the peaks of the Misquah Hills in north central Cook County. The lowest elevation, 602 feet, is the level of Lake Superior. The level of the Mississippi River where it crosses the state line in the southeast corner is 620 feet, and that of the Red River of the North in the northwest corner is 753 feet. A narrow belt below the 100-foot contour occupies the Red River Valley, and follows down the valley of the Minnesota to its confluence with the Mississippi; here it expands to include a large area to the north and east. It follows the Mississippi River, becoming narrower as the southern boundary is reached. Another area below the 1000-foot contour is a narrow strip bordering Lake Superior. There are three areas above 1500 feet: (1) parts of St. Louis, Cook, and Lake counties, (2) parts of Becker, Hubbard, Clearwater, and Mahnomon counties, (3) the Coteau des Prairies, in the southwestern corner of the state.

HYDROGRAPHY

Drainage. Minnesota is the watershed of the portion of the continent lying east of the Rocky Mountains. Its waters drain into Hudson Bay on the north, into the Great Lakes on the east, and through the Mississippi River into the Gulf of Mexico on the south. The water surface, excluding the part of Lake Superior within the state, is greater than that of any state in the union, the average being 1 square mile of water to 20 square miles of land.

The Hudson Bay-Nelson River system drains the northwestern and northern part of the state and drains about 34 per cent of the area of the state. It is represented by the Red River of the North, the Rainy River, and their tributaries. The Red River of the North rises in the southwestern corner of Clearwater County, about 13 miles west of Lake Itasca, the source of the Mississippi River. The divide between it and the Mississippi River is here about 1750 feet above sea level. The divide between the Red River and the Minnesota River is 973 feet. The divide between the Rainy River and Pigeon River on the International Boundary is 1700 feet. The Great Lakes-St. Lawrence River system drains the northeastern part of Minnesota, about 9 per cent of its area. The principal stream of this area is the St. Louis and its tributaries, but there are also many short swift streams flowing directly into Lake Superior. The Mississippi River system is the largest and most important and drains the greater part of the state, or about 57 per cent of its area. Its chief tributaries are the Prairie, Crow Wing, Sauk, Rum, St. Croix, Minnesota, Cannon, Zumbro, and Root rivers. Cedar and Des Moines rivers in southern Minnesota flow through Iowa to the Mississippi. Rock River in the southwestern corner is a tributary of the Missouri River.

Lakes. Excepting the southeast, southwest, and northwest corners, lakes are abundantly distributed over the state. The largest is Red Lake, a shallow body of water with an area of about 440 square miles. Other large lakes are Mille Lacs, Winnibigoshish, Leech, Minnetonka, and Vermilion. In the Lake Park region, beginning near Taylor's Falls, passing southwest to the Twin Cities, and then northwest to Fergus Falls, then north and northeast across the central and northeastern portion of the state, are thousands of lakes of various shapes and sizes. About three-fourths of the lakes of Minnesota occur among the moraine ridges and on outwash areas. Others occur on till plains, in rock basins, in limestone sinks, on flood-plains, and in river channels.

Coast. The northeast projection of Minnesota fronts on the water of Lake Superior, the coast line in the state being about 150 miles. It is a bold, straight shore line rising abruptly from the water's edge several hundred feet. Very few large indentations occur along the entire coast. Small promontories and scattered islands break the monotony near the northern boundary. There are but few good natural harbors. At Two Harbors there is a twofold indentation of the coast by which a double harbor is formed.

more gentle slopes and on their floors there are wide, flat-topped alluvial terraces which rise from 30 to 60 feet above the flood plains of the streams.

INFLUENCE UPON ECONOMIC DEVELOPMENT

The dissected surface of the driftless area has influenced its economic development in many ways. For instance, in this area there is a smaller percentage of land actually in cultivation than in adjacent glaciated sections. This is due primarily to the large amount of land on the slopes of the valleys which is too steep to cultivate. The location of roads and railroads is a second example. On the undissected parts of the upland the roads, except for minor deviations due to small hills or limestone sinks, are built directly between points or on the section lines. In the dissected section they follow the tops of the ridges, converging at the heads of valleys down which they lead to important points in the lowland. Road building is a simple matter on the flat topped terraces but on the flood plains much expensive grading, filling, and bridging is required.

Drainage in this area is active. Because of steep slopes and the absence of lakes and swamps the rivers flood rapidly after heavy rains. On the upland much of the run-off is cared for by sink holes leading to under ground drainage channels. Some of this water collects underground in streams which appear in the valleys as springs of steady flow which supply the drinking water for farm or village. The large number and steady flow of such springs tend to give the streams a uniform volume throughout the year which is of much importance to numerous small grist mills located along their courses.

Because the upper horizons of the bed rock in this area are pervious sandstones and limestones and because of the number and depth of the valleys the permanent water table is far below the surface of the upland. For this reason surface wells on it go dry in periods of drought, which means that the farmers must drive wells from 250 to 400 feet deep in order to have an adequate supply of drinking water.

The flow of water in many of the smaller valleys is intermittent. Their beds and those of the upper reaches of most of the valleys are strewn with boulders brought down during heavy rains. Where the steep slopes of such valleys are not protected by trees and grass and especially where stock has been allowed to graze over them, the soil has been washed away, leaving gullied areas or acres of bare bed rock. Some of the farmers are checking such erosion by practicing contour plowing, by planting the slopes in grass or shrubs, and by building a series of brush or rock dams to decrease the gradient of the valley.

The drainage on the floor of the valley of the Mississippi contrasts with that of the rest of this area. On it are so many sloughs, cut-offs, ponds, and lakes that the river has a semi-braided character. This means that it is impossible to cross it except at points where roads have been built. Consequently, in the early days when Minnesota depended on the river for a com-

mercial outlet, villages developed at every point where the main channel of the river swings near enough to the side of its valley to furnish a landing place accessible to the back country. The location of Winona, the fourth city in size in Minnesota, is an example. It was located at the point where the main channel of the Mississippi impinges on the lower end of Wabasha Prairie which is a large alluvial terrace. This terrace is situated so that the trade from six valleys and a large part of the upland found its outlet to the river at Winona.

AGRICULTURAL RELATIONSHIPS

The driftless area has a variety of soils. Over most of the upland there is a rich, dark colored, fine grained loam derived from the loess which mantles the uplands bordering this section of the Mississippi River. Where the loess is absent the soils are residual, being derived from the underlying sandstone or limestone. Near the border of the drift the soil is modified in some places by thin deposits of sandy outwash gravels. These different soils vary in fertility, which in part explains the variety in crop yields and farm values found within short distances.

The crops grown on the upland are typical for much of southern Minnesota. Barley, oats, and corn are the cereals of largest acreage. They are grown in some plan of rotation with wheat, rye, and forage crops. Stock for market is raised on most farms and much butter is made in local creameries. Such farming, in a climate like that of Minnesota, demands large, well built barns and heavy, expensive machinery.

In the valleys, soils and farm conditions are somewhat different. The soils of the alluvial terraces vary from heavy clay to light sandy loams. Valley farmers grow less cereals than upland farmers. This is due in part to the fact that on most valley farms the areas suited to growing cereals is limited and that the conditions necessary for stock raising are present. In the spring, pasture is furnished on sun-warmed valley slopes and later in the season, during the drought of summer, on the flood plains. In addition springs and streams furnish abundant water for the stock.

Fruits and vegetables also are important products on many valley farms. They grow well on the light alluvial loams of the terraces and in many parts of the valleys they are afforded protection from drifting snows, and excessive freezing and thawing. About the larger valley towns like Winona, Red Wing, Lake City, and Wabasha, there are many small truck farms whose products supply the local demands and in addition are shipped to other sections of the state.

THE CLIMATE OF MINNESOTA

By Eugene Van Cleef
State Normal School, Duluth

MINNESOTA'S continental climate is one of the most diversified among the states in the Great Lakes region. While continental characterizes it in the northeast, the northwest, the central and the southern part, in none of these areas are the variations in the climatic elements just alike. Certain generalizations may be made if the state be divided into a northern and a southern part. Subsequently a few characteristics peculiar to more limited areas will be noted.

IMPORTANCE OF CYCLONES AND ANTI-CYCLONES

The state lies in the path of cyclones and anti-cyclones that pass in a general west to east direction. These extensive areas of alternating low and high pressure are the controlling factor. With them comes the clear weather, the rain, the snow, the heat, the cold, the wind, and all the other elements that either please or displease us. The winds to which some people object are a considerable asset. Over most of the state the northwesterlies prevail; while for Duluth and other points along the shore of Lake Superior, the north-easterlies predominate. The average wind velocity for all the state of 16 to 17 miles per hour deserves respect. It means the almost continual movement of the air, and therefor freshness and stimulation that invigorates the citizens.

TEMPERATURE

The temperature is another important element affecting the welfare of the people. A knowledge of the range of temperature for each season of the year enables the farmer to select seeds of plants that can best adapt themselves to the region. A simple tabulation of the average temperatures for each of the four seasons follows:

<i>Seasons</i>	<i>Northern Minn.</i> F°	<i>Southern Minn.</i> F°
(May		
(June	61—66	67—70
(July		
(August		
(September	39—44	45—48
(October		
(November		
(December	5—13	14—16
(January		
(February		
(March	33—40	41—44
(April		

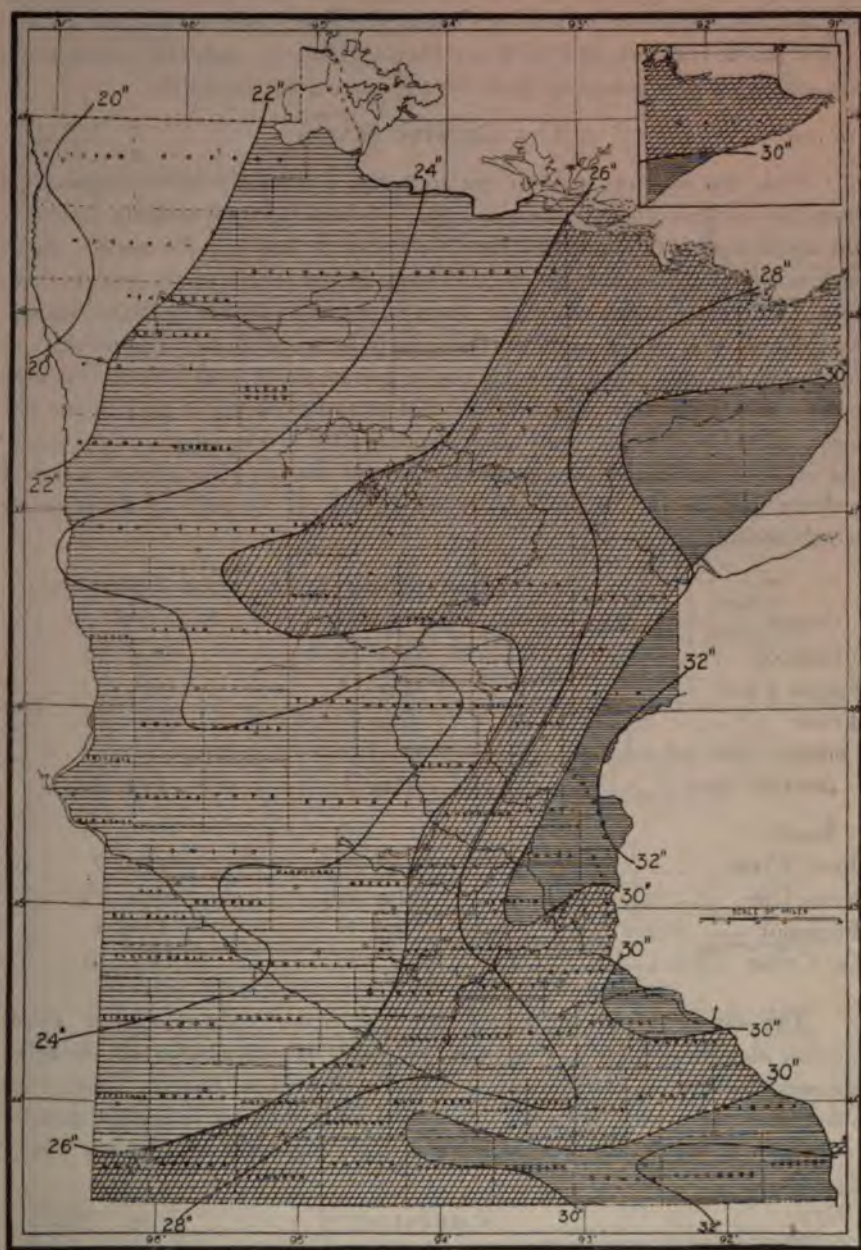


Fig. 1. Map showing average annual precipitation for Minnesota. From Bulletin 12, Minnesota Geological Survey.

The highest temperature ever recorded in the northern part of the state is 104° at Crookston, and the lowest -59° at St. Vincent. 41° below has been observed at nearly all points in this section. In the southe

of the state a maximum of 107° at Grand Meadow stands as the record, while —44° has been known at Pine River Dam. However, such low temperatures are somewhat rare compared with their frequency in the north.

THE GROWING SEASON

That the northern part of the state has a markedly lower temperature than the southern districts is easily seen. Perhaps the most striking feature is the decidedly lower minimum from November to April in the north. Right here is one of the reasons for the difference in the length of the growing seasons. In the neighborhood of the Twin Cities and southward the spring season exceeds that in the more northerly part by as much as three weeks. A more detailed tabulation showing the temperatures of every month or even every week of the year would reveal that most significant of all climatic elements so far as crops are concerned, namely, frost. The length of the growing season is determined by the average date of the last killing frost in spring and the first killing frost in fall. A few figures for the parts of the state are worth noting:

	Last Killing Frost Spring	First Killing Frost Fall
<i>North—</i>		
Crookston	May 22	Sept. 15
Fergus Falls	May 11	Sept. 22
Tower	June 5	Sept. 13
Duluth—lake influence controls here	May 3	Oct. 3
<i>South—</i>		
Twin Cities	April 29	Oct. 7
New Ulm	May 6	Sept. 25
Fairmont	May 6	Oct. 3
La Crosse (Wis.)	April 30	Oct. 10

The statement was just offered that frost is the "most significant" of all climatic elements, so far as crops are concerned. Provided that all the other elements balance, this statement is correct. But even though frost were absent and there were no precipitation, certainly without irrigation nothing could grow. So, perhaps, after all there is no single element that is "most significant."

RAINFALL

The average annual rainfall ranges from 30 inches in the eastern parts to as low as 20 inches in the extreme northwest. Most of the valley of the Red River of the North has between 20 inches and 25 inches of rainfall. The distribution throughout the year, as in the case of other climatic elements is interesting. Over the entire state the rainy season is primarily during the summer months. Everywhere June is the rainiest month. In the northeastern



Fig. 2. Map showing average date of first killing frost in autumn in Minnesota. From Bulletin 12, Minnesota Geological Survey.

part of the state a secondary maximum occurs in September. It is to this crease in moisture that the northeastern part of the state owes its seemingly unexcelled grasslands. The rain rarely comes in excessive falls but rather

normal showers. Thunderstorms are seldom severe and tornadoes have in only one or two instances given the inhabitants any concern.

SNOWFALL

Minnesota's reputation for fearful blizzards and a tremendous snowfall is not altogether substantiated by the figures. In the north-central and the northeastern parts it amounts to 54" in depth; in the northwest 35", in the southwest 30", and in the southeast 40" to 50". When recorded under the general heading of precipitation, that is, as water, these figures are divided by 10. Compare the figure of 36.3" of snowfall for Chicago, a point usually considered as being free from heavy snow, with St. Paul having 37.1" or Crookston with 35.8". Then why the reputation? A return to the temperature figures shows us that practically at no time during the winter season do they rise above the freezing point. Hence the snow accumulates, so that by midwinter and the oncoming of spring several feet of snow have piled up. In Chicago shortly after each snowstorm a thaw occurs. Hence no snow remains on the ground.

In Minnesota the snow, after lying on the ground awhile, freezes. This frozen snow surface makes the building of roads in the forest easy, and so facilitates hauling out of the cut timber. In the farming districts the snow cover serves as a warm blanket for the soils, and in spring the melting snows add moisture to the soils. More directly influencing the individual is the fact that a snow cover prevents the dust from being swept up by the wind and therefor gives a purer atmosphere to breathe.

HUMIDITY

The relative humidity is about normal, ranging from 70% to 80%. With a moderate rate of evaporation and a rather low rainfall in the northwest, the normal relative humidity becomes comparatively high. This means that the water that falls, instead of evaporating rapidly, seeps through the soil and is conserved. Hence plants can get the necessary amount of moisture even in a region of limited precipitation, and crops develop wonderfully.

The percentage of *cloudiness* increases naturally as one approaches Lake Superior. Here it is as high as 55%, while in the extreme western part of the state it falls to 45%. The distribution of sunshine, of course, is the complement of cloudiness.

Hail and fog are infrequent. "Land and sea" breezes occur occasionally along the shore of Lake Superior; but these are not at all pronounced. The observation of the *Aurora Borealis* offers a frequent source of pleasure and thrill to the residents of the northern part of the state.

INSOLATION

The high percentage of insolation received during the growing season deserves special mention. Sometimes wonder is expressed that such a short



Fig. 3. Map showing average date of last killing frost in spring in Minnesota. From Bulletin 12, Minnesota Geological Survey.

growing season as is here experienced should permit of such vast production. The answer is found in the fact that the days are long; the longest one approximates 16 hours. With a long period of twilight and of dawn in addi-

tion, as much light is available for the plants in two and one-half months as in some places further south where the growing season is four months long, for in the latter localities the length of day is considerably less.

The combination of fertile soils and, sufficient rainfall, normal relative humidity, moderate summer temperatures, low rate of evaporation, constant snow covering in winter, and long hours of sunshine in summer, ranks Minnesota as an agricultural state among the first ten in the country. It also gives to its people an aggressive spirit that is not excelled anywhere.

MINNESOTA

THE WATER RESOURCES OF MINNESOTA

By F. G. Tryon

Rhodes Scholar-elect from Minnesota

MINNESOTA contains the sources of three great drainage systems, the Mississippi, the Nelson, and the St. Lawrence. The basin of each of these three river systems is the seat of valuable water powers within the borders of the state. Of the three, the water powers of the Mississippi and its tributaries are the most numerous and develop the most power.

In a given region the amount of available water power varies with the stream gradient and the amount of run-off. Run-off is the amount of rain falling minus the water returned to the atmosphere through evaporation from open bodies of water, from the soil, and from the leaves of plants.

The highest point in the state is in the hills north of Lake Superior which reach an altitude of 2230 feet, while the lowest point is the level of the lake itself (602 feet). The relief for Minnesota is thus 1628 feet, which is not great considering the area of the state; in comparison with the relief in the Pacific Coast or the New England states, it is insignificant. This relatively low relief tends to limit the available water power in Minnesota.

Minnesota is not a region of exceptionally heavy run-off. While the losses from evaporation are as low as in any area of equal size in the country, yet the moderate rainfall of 27.6 inches, upon which run-off primarily depends, suggests a relatively low run-off. The mean annual run-off varies from 1.1 inches for the Minnesota River watershed above Montevideo to 9.9 inches for the St. Croix River above St. Croix Falls. For the Mississippi watershed above St. Anthony Falls it is 5.3 inches. That is, every year enough water flows over St. Anthony Falls to cover the 19,500 square miles of watershed with a layer of water 5.3 inches deep. By way of comparison it is interesting to note that the run-off of the Ohio River above Wheeling is 22.0 inches.

It is not surprising to find as a result of these factors affecting the run-off that the total amount of available power in Minnesota is much less than in regions of more rugged topography, where slopes are steep and rainfall heavy. As a matter of fact, Minnesota ranks twenty-second among the states of the Union in potential water power. At the head of the list stands Washington,

followed by California, Oregon, Montana, Idaho, Arizona and New York, in order of rank. Louisiana possesses the least potential water power. Minnesota stands about the middle of the list with one-seventeenth as much available power as Washington, and 290 times as much as Louisiana.

While the available power in the state is not great in comparison with the mountainous states, Minnesota streams are in general less subject to fluctuations in flow than those in many other states, and therefore are more satisfactory to the builder of a mill or a hydro-electric plant. The last great glacier which covered Minnesota left in its retreat many lakes, swamps, and undrained depressions which act as natural reservoirs, preventing floods and equalizing the flow of rivers from season to season. The advantages of this greater regularity of flow to the builder of a dam for water power are many. Where heavy floods are rare, a dam need not be as heavy as one for the same sized stream more subject to heavy floods. Moreover, fewer water turbines would be lying idle during the season of low water, for with absence of floods usually goes absence of very low water. While the flow of the Mississippi at St. Anthony Falls is far less uniform than that of Niagara, where the Great Lakes form a perfect natural reservoir, yet it is steadier than most streams in unglaciated country.

In addition to the natural reservoirs formed by the retreating ice sheet the U. S. Corps of Engineers has constructed six reservoirs on the Upper Mississippi capable of holding 98,000,000,000 cubic feet of water. The largest of these is located at the outlet of Lake Winnibigoshish, which with the Leech Lake reservoir holds more than three-fourths of the total capacity. Smaller reservoirs have been constructed at Pokegama Falls, at Gull Lake, at the outlet of Cross Lake on Pine River, and on Sandy River, one mile above its junction with the Mississippi. The reservoirs were constructed primarily to facilitate navigation and to assist in the control of floods, but hydraulic engineers have urged that the stored water be used for water power at the reservoir dams.

In estimating the power available at any site, the question as to whether to design a plant large enough to utilize the flood flow of the stream, or one only large enough to utilize the minimum flow, during the period of low water depends upon the market for power. Where the price per kilowatt is low, the tendency is to utilize only the minimum flow of the stream. In Minnesota, where the cost of generating steam power is considerable because of the high price of coal, and where the market for power is active, it is frequently found practicable to build a plant large enough to utilize the flow of water during the highest six months of the year. The extent of development also depends on the use for which the power is destined. The electro-chemical industries, for example, require an amount of current absolutely constant, year in and year out. A hydro-electric plant supplying power to such an industry may be no larger than can be operated by the extreme low-water stage of the river, unless the deficiency can be supplied by auxiliary steam. On the other hand, a wood-pulp mill can utilize the high-water flow of the stream

grinding quantities of pulp during high water to be stored until needed at the time of low water.

Keeping these principles in mind, we may understand the estimates of water power available in Minnesota. On the basis of the "minimum flow" during the lowest week of an average year, the potential power is 278,000 horsepower. On the basis of the flow during the highest six months, the power available becomes 494,000 horsepower, a trifle less than one per cent of the potential power in the entire United States. The power actually developed in the state, as indicated by the capacities of the plants now installed, is 188,000 horsepower or about $4\frac{1}{2}$ per cent of the power developed by water in the entire country. Minnesota's water powers are thus more completely developed than those of the country as a whole. From a comparison of the potential and developed power, it may be seen that, on the basis of the minimum flow alone, there remain 90,000 horsepower to be developed in the future. The State Drainage Commission acting in cooperation with the U. S. Geological Survey has published, in the Report of Water Resources Investigation of Minnesota, surveys of unoccupied dam sites of not less than 15 feet head which would develop during the month of lowest flow 120,000 horsepower. As the future development of these sites will doubtless be on a much higher basis than the minimum flow, we may expect the horsepower derived from Minnesota streams ultimately to approach 500,000.

The largest power development in the state is at Minneapolis at the Falls of St. Anthony, where three installations have a combined rating of 57,000 horsepower. Other important developments are Taylor's Falls, 18,750 h. p.; a plant a few miles below Thomson on the St. Louis, 39,000 h. p.; International Falls, 18,000 h. p.; Sartell, Little Falls, and Coon Creek on the Mississippi above Minneapolis, 6,000, 4,100, and 7,500 h. p., respectively; Grand Rapids, 3,600 h. p.; and St. Cloud, 1,750 h. p. Above Fort Snelling on the Mississippi the government high dam now under construction will develop about 15,000 h. p. Other important plants are found at Knife Falls, Cloquet, Brainerd, Cannon Falls, Mankato, and Red Lake. Much of the undeveloped power available is to be found at the sites of these principal installations.

Mention has been made of the economy in using water power in the manufacture of wood pulp. The inhospitable soil of much of northeastern Minnesota, better adapted to forest than to farm, guarantees a constant supply of spruce and hemlock to be ground into wood pulp by power furnished by the numerous streams. The development here of a permanent industry in wood-pulp paper seems assured.

As is well known, it was the Falls of St. Anthony which created Minneapolis. As early as 1821 a rude sawmill was built at the falls to make lumber for the first permanent structure at Fort Snelling. Two years later the first flour mill was erected. It was the combination of cheap power, the northern pineries on the river above, and the grain fields of the Northwest that deter-

mined the location of the city. To this day flour and gristmill products, and lumber and timber products remain the leading manufactures of the state.

Before the days of long-distance electrical transmission, power derived from falling water could be utilized at no greater distance from the water wheel than the length of a belt drive. Modern electrical engineering has made possible the profitable transmission of electrical energy from 100 to 300 miles, the distance depending on the cheapness of competing sources of power. Power sites at a distance from large cities have been tapped to provide electricity for lighting, transportation, and manufacturing. Minneapolis has grown to such proportions as to require more power than the Falls of St. Anthony can furnish; Taylor's Falls on the St. Croix, and Coon Rapids on the Mississippi have been developed to supply the deficiency. The high dam at Fort Snelling is now about to furnish light and power to the same city. In like manner, electric lighting in St. Paul is supplied by current generated at a distance in scattered water-power plants.

As an accompaniment of the multiplication of plants supplying a single market has appeared the tendency to concentrated ownership and operation. The company supplying Minneapolis with light operates three hydro-electric plants at Taylor's Falls, St. Anthony Falls, and Coon Rapids as parts of a single system. This tendency is inevitable and will doubtless proceed further. "The Mississippi River between the mouth of the Crow Wing River and St. Anthony Falls has more undeveloped water power than any other river in Minnesota. The country through which it flows is the most thickly settled portion of the state, affording the best market for power." Unquestionably the future will see these power sites developed by a single agency and managed as part of a single system.

Concentration of ownership, while necessary, has its dangers. To devise means for its adequate regulation is the task of a far-sighted government.

MINNESOTA

THE IRON ORES OF MINNESOTA

By W. H. Emmons

University of Minnesota

MINNESOTA ranks high among the states in the production of metals, a place it owes to its deposits of iron ore. Its output of iron ore exceeds that of all other states combined both in amount and value, being (in 1912) 34,249,813 long tons valued at \$61,805,017. Iron is mined in Minnesota on three ranges, the Mesabi, the Vermilion, and the Cuyuna. Of these the Mesabi is the most important iron-mining district in the world. Although shipments began as late as 1892, it had produced at the end of 1913 about 50 per cent of all the iron ore produced in the Lake Superior region up to that time.

The more important mining centers of Minnesota are all located

100 miles of a Lake Superior port, and all of the iron ores are within 125 miles of Duluth. The ores from the three ranges are carried by rail to Duluth, Two Harbors, or Superior, where they are loaded into lake freighters and shipped to lower lake ports. Essentially all of the ore is smelted with eastern coke. It is about as economical to carry iron ore to coke as to carry coke to iron ore; iron and steel plants are therefore located near the coke fields, near the iron fields, or on the lines of transportation between the two. Thus great industries have been built up at Duluth, Sault Ste. Marie, Milwaukee, Chicago, Gary, Detroit, and at many places in Ohio and Pennsylvania. These supply the iron and steel markets which are most accessible to them. The freight saving in the distribution of the product that is obtained from widely spaced smelting centers over distribution from a single center is obvious.

The prices paid for the ores depend upon their composition and character. Because it is more easily smelted in the furnace, hard ore brings about 25c a ton more than soft ore. Iron made from ore with very low phosphorus content can be used in Bessemer furnaces which produce steel at low cost, and such ore sells for about 65 to 75 cents a ton more than non-Bessemer ore. The prices in 1915 for Mesabi non-Bessemer carrying 51.5 per cent iron in the natural state was \$2.80 per ton at lower lake ports, and for Bessemer, carrying 55 per cent, it was \$3.40. The prices increase rapidly for ores above the grades mentioned because as iron increases, silica and alumina generally decrease. These must be fused along with iron and removed in smelting, and their removal requires more labor and fuel and decreases the iron output ratio of the furnace. The railway freight rate from Mesabi to upper lake ports is 55c a ton, and the lake freight is an additional 55c, including dock charges. Deducting freight charges at \$1.10 the value on the Range of non-Bessemer ore of the grade mentioned is \$1.70 and of Bessemer ore \$2.30. Penalties are charged for ore below grade and premiums paid for that above grade.

By far the greater portion of the ores are shipped as they are taken from the mines; some, however, are crushed before shipping. At one plant they are dried, and in three plants the ores are concentrated by removing the sand and clay before shipping. The largest concentrating plant is near Coleraine on the west end of the Mesabi Range. The ore is passed with water through screens and washers and over tables which remove sand and clay. It has a capacity of about 3,000,000 tons of crude ore a season. A washing plant at Nashwauk treats 4000 tons of crude ore a day and a smaller one near Virginia treats 400 tons.

On all the ranges the principal iron mineral of the ores is iron oxide or *hematite*. In the original material from which the ore was derived the iron occurs chiefly as the carbonate, *siderite*, and the silicate, *greenalite*. On the east end of the Mesabi Range, near intrusions of igneous rocks, there is much *magnetite* in the iron formation. This material is too low grade to be marketed without previous concentration, and it is not now utilized. In St.

Louis and Cook counties there are deposits of titaniferous iron ore. With present furnace practice titanium is objectionable and these ores are not now marketed.

THE MESABI RANGE

Location.—The Mesabi iron district* is northwest of Duluth about 60 to 90 miles. In this region the most conspicuous feature is the ridge called the Giants or Mesabi Range. In the western part of the district this ridge is only 1,400 feet above sea level and not appreciably higher than the surrounding country. From Virginia eastward it is from 1,700 to 1,900 feet above sea level and some 400 feet above the surrounding country. The lower areas are covered with glacial drift, and much of the country is marshy and thickly wooded. Nearly everywhere the ore is concealed by from 20 to 200 feet of surface debris, except at the east end of the range where there are numerous exposures.

Discovery.—The presence of iron in the east end between Embarrass and Birch lakes was known to the earlier explorers, but the ore there is low grade and the rich ore was not discovered until 1890 when test-pitting by a crew employed by the Merritts of Duluth led to the discovery of rich ore near the present site of Iron Mountain. Soon afterwards, in 1891, W. J. Merritt discovered the Biwabik ore body.

Geology.—The ore occurs in a single sedimentary formation extending from a point about 12 miles southwest of Pokegama Lake, eastward about 100 miles to Birch Lake. At the surface this bed strikes about N.73°E., dips southward at low angles, and is from 1 to 3 miles wide. At Virginia and Eveleth there is a great loop in the iron formation which increases its exposure. The iron formation (Biwabik) is of pre-Cambrian age, belonging to the Upper Huronian series (Animikee). Below it is the Pokegama quartzite or older formations and above it is the Virginia slate. These three formations were laid down in water, one above the other, but afterward were elevated and tilted so that nearly everywhere they dip southward at low angles, about 15°. Their upturned edges are eroded to nearly the same level and covered with glacial drift which is in general from 20 to 200 feet thick.

Since at the surface the iron ore deposits are covered over with glacial

* Winchell, N. H., and Winchell, H. V., Geological and Natural History Survey of Minnesota: Vol. 4 Final Report, 1892-96, Vol. 5 Final Report, 1898-1900.

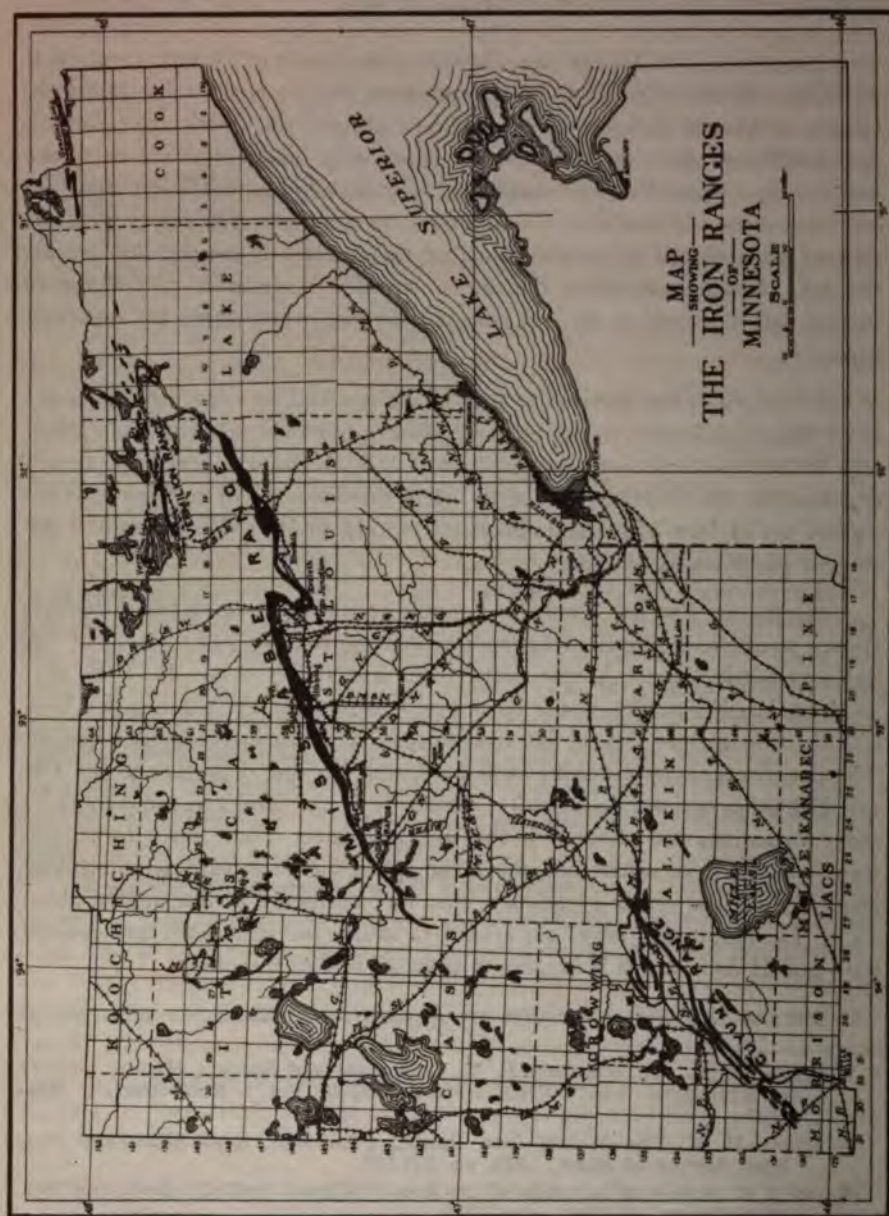
Winchell, H. V., The Mesabi Iron Range: 20th Ann. Rept. Geol. and Nat. Hist. Survey of Minn., 1893, pp. 111-180.

Spurr, J. E., Iron-bearing rocks of the Mesabi Range: Bull. 10, Geol. and Nat. Hist. Survey of Minn., pp. 1-268.

Leith, C. K., The Mesabi Iron Bearing District of Minnesota: Mon. 43, U. S. Geol. Survey, 1903.

Van Hise, C. R. and Leith, C. K., Geology of the Lake Superior region: Mon. 52 U. S. Geol. Survey, 1911, pp. 159-197.

drift most of the deposits have been discovered by drilling. The iron-bearing bed, as already stated, is of sedimentary origin, but in its original condition it was not rich enough to work. By weathering or rotting at the surface the



materials other than iron are leached out leaving the iron oxide comparatively pure. Silica has been removed in large amounts and pore space has been developed through its loss. This leaching took place long before the glacial

period, and probably a considerable part of the iron ore was removed during glacial time. The average thickness of the iron-bearing bed is about 800 feet, but on account of its very low dip, the width exposed is in general from 1 to 3 miles. Only a comparatively small part of the upper surface of the iron formation is changed to iron ore.

Mining Methods.—The valuable deposits are confined practically to shallow depths. In many mines the ores are valuable not over 200 feet below the bottom of the overlying glacial drift and rarely ever do they extend downward over 400 feet. The length and breadth of the deposits are so great, however, that the amount of ore is very large notwithstanding its comparatively shallow depth. The drift capping is first removed and the ore, which for the most part is soft and powdery, is shoveled up by steam shovels and loaded directly into steel cars. Thus the mining costs are very low. In a few mines underground mining is carried on. The ore in them is recovered at greater expense, but not all of the ground lies favorably for surface mining on account of the great thickness of glacial drift or other barren material above the ore. The underground mines are worked also during the winter season, thus giving employment for some of the labor throughout the year.

THE VERMILION RANGE

The Vermilion Range* is northeast of the Mesabi Range and extends from Vermilion Lake to Gunflint Lake on the Canadian boundary. It is about 100 miles long and in width it varies from 5 to 15 miles. Although the presence of ore in this range was known as early as 1850 the region was not extensively explored until 1875. The first ore was shipped from the Vermilion Range in 1884. The rocks are ancient schists, complexly folded and crumpled and the iron ore deposits are not so nearly continuous as they are on the Mesabi Range. Like the Mesabi ores they are surface concentrations of iron-rich sedimentary beds, but some of the Vermilion ores, after they were concentrated by weathering or surface decomposition, were buried under great thicknesses of later rocks and closely folded. Thus the ores which probably were soft and powdery like most of the ores of the Mesabi Range, have been converted by pressure into hard, heavy, iron ore schists. By reason of their close folding the ore deposits vary greatly as to depth. Although they were formed at the surface, some are now to be found many hundreds of feet below the surface, and deep mining is necessary to recover them. A few shallow pits have been dug on the Vermilion Range, but practically all of the ore is obtained from the deep shafts. Although the range is as long as the Mesabi, and somewhat wider, the ore beds are not so large and not so easily

* Grant, U. S., Winchell, N. H., and others: Geol. and Nat. Hist. Survey of Minn., Final Rept., vol. 4.

Clements, J. M., The Vermilion iron-bearing district of Minnesota: Mon. U. S. Geol. Survey, vol. 45, 1903.

mined. The district has been worked through a longer period but has produced only a little more than one-tenth as much ore as the Mesabi Range.

THE CUYUNA RANGE

The Cuyuna Range* is west of Duluth and southwest of the Mesabi Range. It extends from the town of Aitkin southwestward through Deerwood, Crosby, and beyond Fort Ripley. It is at least 55 miles long and of undetermined width. The Cuyuna Range was the last of the Minnesota ranges to be discovered. The ore does not outcrop at the surface, but is covered over with glacial drift from 75 to 400 feet deep. The presence of magnetic rocks in this region was discovered about 1895 by Cuyler Adams, with a dip needle. The first drilling was done by Adams in 1903. The range has been prospected entirely by the use of the magnetic needle and drill. The iron ore is not itself magnetic, but is associated with magnetic formations and the location and strike of these beds below the surface is generally determined by magnetic surveys in advance of drilling. The ore deposits of the Cuyuna Range are in rocks that are approximately of the same age as the rocks of the Mesabi Range, but the formation which contains them is enclosed in the Virginia slate which, on the Mesabi Range, is above the iron formation. The workable deposits are steeply-dipping lenses which have a maximum width of about 500 feet. The average depth is about 300 feet, but some ores are found nearly 1000 feet below the surface. Locally, where the width of the ore deposits is sufficient, the glacial drift is stripped off by steam shovels and the ore is mined in open pits much as on the Mesabi Range. The drift is so thick, however, and the deposits are so narrow that a large part of the ore will probably be mined by underground methods.

MINNESOTA

PEAT IN MINNESOTA

By E. K. Soper, University of Idaho
Recently of the University of Minnesota

IT has long been known that Minnesota contained large peat deposits, especially in the northern part of the state, but until recently little has been known regarding the quantity, character, distribution, or value of this material. In 1914 the Minnesota Geological Survey, in co-operation with the United States Geological Survey, began an investigation looking into the extent and value of the peats of Minnesota, and the results of this investigation will probably be published soon as a bulletin by the United States Geological Survey, for free distribution throughout the United States. This re-

* Leith, C. K., *The geology of the Cuyuna Iron Range, Minnesota: Econ. Geol.*, vol. 2, 1907, pp. 145-152.

Adams, F. S., *The Iron Formation of the Cuyuna Range: Econ. Geol.*, vol. 5, 1910, pp. 729-740.

Zapffe, Carl, and Barrows, W. A. Jr., *The Iron Ores of the South Range of the Cuyuna District: Trans. Amer. Inst. Min. Eng.*, vol. 44, 1913, pp. 3-13.

port will include not only descriptions of the origin, character, and distribution of the peat deposits, but also chapters dealing with the various uses of the material and the methods and costs of preparing it for these uses.

THREE GROUPS OF PEAT DEPOSITS

In a general way, the peat deposits of Minnesota fall into three more or less distinct groups: (1) those in the northern part of the state, the so called "muskeg" swamps, the peat in which is formed chiefly of *sphagnum* or *peat moss*; (2) those in the central part of the state, formed sometimes in smaller sphagnum bogs, sometimes in open "wire grass" marshes, and sometimes in bogs which are combinations of both of these types; and (3) those in the southern part of the state which are always in open meadows and which never contain sphagnum.

THE NORTHERN DEPOSITS

The sphagnum peat of northern Minnesota is by far the most important from the viewpoint of quantity as well as of quality. The largest deposits lie in the muskegs of St. Louis, Koochiching, Itasca, Beltrami, Roseau, Crow Wing, Aitkin, and Carlton counties. These swamps occupy, for the greater part of this area, portions of the old lake bed of the ancient Lake Agassiz which covered the region in glacial times and which has gradually dried up until today it has receded northward to Lake Winnipeg (Manitoba), a remnant of this former immense body of fresh water. As this great water area gradually disappeared, the newly exposed land, as would be expected, was without adequate drainage. The depressions and irregularities in the surface became the sites of small, shallow lakes or ponds around which there quickly sprang up a type of vegetation very similar to, if not identical with that which now fringes such ponds on low, marshy land. The areas around the shallow ponds were subject to inundation during the wet seasons and were kept constantly wet. Thus were brought about conditions favorable to the rapid growth of peat-forming plants.

As these plants died, their remains were prevented from decay by the excessive moisture which kept the region constantly wet. In this way large peat beds rapidly accumulated over much of this region and, in fact, are still accumulating in practically every muskeg swamp in northern Minnesota.

The most important peat former is sphagnum moss and it forms fully ninety per cent of the peat in the state. Where the peat has accumulated by the filling up of shallow lakes and ponds with vegetable remains, that part of the deposit which lies below the former water level of the lake is usually formed of plants other than sphagnum; the most important of these are pond weeds, lake bull rushes, cat tails, and various sedges. After the water has completely disappeared and a level mat of the remains of these aquatic plants is all that remains, the sphagnum soon crowds out all the other plant types and from that time on, the peat bed is built up layer after layer by successive generations of sphagnum.

There are, of course, numerous small peat deposits in this region,

especially in the southern part of it, which are not muskeg bogs, and which are formed largely from sedges and grasses. The greater portion of the peat areas of northern Minnesota, however, do not represent filled lakes, but built-up moist depressions, and from top to bottom are formed almost entirely of sphagnum.

THE CENTRAL DEPOSITS

The peat deposits of central Minnesota are in part identical in origin and history with those just described. However, sphagnum moss does not grow, except in rare, isolated occurrences, south of an east-west line drawn approximately through the cities of Minneapolis and St. Paul. Hence, north of this latitude, the peat is of the same general type as that of northern Minnesota; and south of it the peat is of an entirely different type; while along a belt twenty-five to thirty miles wide, near this dividing line, there are numerous deposits of each type, and sometimes deposits which represent combinations of both. The peat bogs of central Minnesota are not nearly so large as those to the north, but are much larger than those south of this region. The best and largest deposits lie in Anoka, Ramsay, Wright, Hennepin, Stearns, Sherburne, Isanti, Washington, Chisago, Millelacs, Douglas, and Pope counties.

THE SOUTHERN DEPOSITS

The peat of southern Minnesota is always found in open, treeless meadows or marshes, and is composed chiefly of sedges, grasses, cat tails, rushes, and other plants which are common to such an environment. The peat beds represent, in part, filled lakes and ponds, and partly built-up deposits on low undrained areas. They occupy the low land around the shores of lakes, or along river valleys, or merely low undrained depressions in the drift. They are usually small in area and shallow in depth compared with the peat bogs of the north, but nevertheless numerous deposits of commercial value exist, especially in Blue Earth, Nicollet, Le Seuer, Rice, Scott, Carver, Dakota, and Freeborn counties.

QUALITY

The quality of the Minnesota peat, especially that from the northern portion of the state, compares very favorably in its fuel value with that from any part of the world. Some of the European peat is more decomposed and contains less ash and hence contains more heat units pound for pound. On the other hand, a large part of the peat used commercially in European countries, especially that in Sweden, Denmark, Germany, Russia, and Switzerland, is formed from the same plants in the same way as that found in Minnesota, and is almost identical with it in its composition and physical properties.

As to the quantity of peat in the state, it is not yet possible to give even approximate figures. An idea of the vast amount available may be gained, nevertheless, from the fact that one of the northern bogs is nearly one thousand square miles in area, over which the peat is *at least* seven feet thick. On the assumption that 200 tons of air-dry machine peat can be made per acre for

each foot in depth, this bog alone contains approximately 896,000,000 tons of air-dry machine peat fuel.

USE

It seems probable that the most profitable commercial use which can be made of the peat in Minnesota at the present time is the manufacture of power in peat producer-gas plants. This has been highly successful in a number of large plants in Europe, and there seems to be no reason why their success can not be duplicated here. As the rapidly diminishing timber supply of northern Minnesota becomes exhausted, peat will be used more and more for fuel. Already the coal resources of the United States have shown great depletion, and in the near future we may expect to see the beginning of this new industry—the manufacture of machine peat for domestic fuel.

—MINNESOTA—

THE CLAYS OF MINNESOTA*

By F. F. Grout

University of Minnesota

WHILE the clays of Minnesota play a subordinate part in her mineral resources, due to the importance of iron ore, there is in the state a noteworthy industry based on a considerable variety of clays. Furthermore, a careful study of the materials and a search for deposits now concealed, may lead to notable developments in the future. Even now the clay industry in Minnesota involves from one and a half to two million dollars annual production, a large part of which is pottery and sewer pipe from the deposits near Red Wing. Common and fancy brick are produced in all parts of the state, and no better building material can be found than is made within the state.

Near Red Wing the clays are light gray, and banded, and were accumulated in Cretaceous time. Later geologic events have disturbed them somewhat, and to some extent, isolated the relatively small parts of a large formation. Smaller fragments of the same formation are known in other places in the neighborhood. Much of the clay needs washing, before it is in condition for use in making stoneware, as it contains some coarse and dark-colored minerals. Sewer pipe are made from the poorer grades of clay in the same deposits, and for these, no washing is needed. The thickness of the clay deposit is variable, rising to a maximum of over 40 feet, though many layers of sand are interbedded. The clays used at Red Wing are shipped in a few miles from Clay Bank and Belle Chester.

The Decorah Shale.—There is a large shale formation—a hardened clay—of very different character, extending from the vicinity of St. Paul, south and southeast. This is known as the Decorah shale, from outcrops at Decorah, Iowa. It is a green shale, and likely to be contaminated with lenses

*Acknowledgements are hereby made to Bulletin 11, Minnesota Geological Survey, "The Clays and Shales of Minnesota," by Messrs. Grout and Soper.

and layers of limestone. Most of it is very fusible, and the burned product is colored by the iron it contains. However, the process of fusion is gradual and if it is carefully controlled, brick and tile can be burned to a very dense vitrified product. At West St. Paul, many fancy-front brick and "klinker" brick are produced with a large assortment of handsome colors.

Other Deposits.—The other bed rock formations of the state which have ceramic interest are: more fusible Cretaceous shales known at Springfield and New Ulm; the residual kaolins of the Archean and Huronian; and the somewhat metamorphic slates. It is thus evident that while Minnesota has not extensive refractory shales, that compare with those of Illinois and Ohio, there are large formations capable of making excellent ware.

These are the clays of the state, which, having been formed by some mineral alteration in early geologic ages, and having accumulated in beds of considerable thickness, were incorporated in a series of rock formations, often associated with sandstone and limestone. If they were covered by a great weight of overlying beds they were hardened into shale, but this does not prevent their use as a clay. Unfortunately for the development of these clays in Minnesota, more recent geologic events have spread a mantle of debris over most of the bed rock clays and they are rarely seen except in the gorges of the rivers.

The Glacial Drift.—The concealing mantle, however, has in itself some interest as a clay. It is the glacial drift brought into its present neighborhood by the action of a great continental glacier. This ice sheet entered the region from two or three directions, and on its way gathered in portions of the clay beds it crossed. These clays, mixed with sand and rock, now form the drift mantle. Scarcely a county in the state lacks drift clays that can be manufactured into common brick.

A large part of the state received a cover of *gray drift*, material which came from the northwest and which contains a high proportion of lime. The texture and physical state of this lime has been the decisive point in the success or failure of the attempts to use the clays of the drift. If the lime is in the form of pebbles, there is difficulty in making good brick without an expensive treatment to counteract their effects. However, along the rivers and in some of the lakes, Nature has done the preliminary washing and clays of the gray drift have been freed from pebbles. These make excellent cream colored brick and fireproofing. Where the demand for brick and drain tile warrants it, an artificial process can be conducted so as to yield good results; as, for example, at Hutchinson. Some other methods of utilizing the gray drift have at least partially succeeded; and attempts have been numerous, because of the large amounts of the clay in easily accessible places.

In the northwest quarter of the state this drift was once flooded by a glacial lake—Lake Agassiz,—and its deposits, as well as those of the Red River, now draining the area, are of a slightly different type. The clays, however, have the same defect, the small fragments of limestone.

In the eastern and northeastern quarter of the state there is a superficial

deposit of *red drift* which is radically different from the gray. A much smaller proportion of the drift is clay, and when clay occurs, it contains pebbles, not of limestone but commonly of granite and related rocks. These do not have so serious an effect as the limestone, which may slake and swell after burning, but the clay is, of course, improved by their removal. A large plant at Coon Creek, near Minneapolis, is using the red drift clay, after passing it through conical rolls to remove pebbles. The product is an excellent grade of hard red brick, for the clay can be safely vitrified. In the few places where Nature has washed the pebbles from this red drift clay, the resulting clay is extremely plastic and shows such a high shrinkage as to make it difficult to manufacture. It yields good vitrified products, however, as shown by its use at several plants in Wisconsin. Such clay is abundant around Lake Superior and along the St. Croix River.

In a few places, notably at Wrenshall, and along the rivers farther south, washed clays have been mixed by natural processes, being derived partly from the gray and partly from the red drift.

In the southeastern corner of the state there is an area in which are many deposits of *loess*, a material derived by some process of working over and assorting surface material. The loess is used at Preston and elsewhere for excellent red brick.

—MINNESOTA—

ROCK QUARRYING INDUSTRY IN MINNESOTA

By T. M. Broderick
University of Minnesota

THE stones quarried for building purposes in Minnesota are chiefly granite, sandstone, and limestone. The limestone area is mainly in the southeastern part of the state, along the Mississippi river, and westward to the middle and southern parts of the state. The sandstone occurs along the western boundary of the limestone area, in the southwest corner of the state, and near Lake Superior. The important granite producing areas are along the upper Minnesota valley at Ortonville and Redwood Falls, and in the section centering about St. Cloud. As most of the state is covered with drift the quarries usually occur along the sides of the valleys where the streams have exposed the bed rock.

The region in Stearns, Benton, Sherburne, and Kanabec counties, but centering mainly about St. Cloud, is the largest granite producing area in the state. Here pink, red, and gray granites are quarried. The coarse grained pinkish-gray granite in the basement of the new capitol at St. Paul is from the St. Cloud quarries. The red stone is used for polished monumental works, pillars, and columns. The gray stone is used for monuments, building stone, curbing, and paving blocks. In the vicinity of Ortonville a dark red granite is quarried which is being used extensively in the Twin Cities.

In the southwestern corner of the state a quartzite, locally called granite

on account of its hardness, is quarried. It is taken out in Rock and Pipestone counties, and there is another area centering at New Ulm. This quartzite is used for building material near where it is quarried, but its largest use is as crushed stone for road construction. On the Kettle river at Sandstone, Pine County, a fine grained, light pink sandstone is quarried. The quarry is operated on a large scale and has all the facilities for a large output of stone. The principal products of this quarry are building stone, crushed stone, sawed stone, rubble, paving blocks, curbing, bridge stone, coping, and monument bases. The library building at the University of Illinois is built of this stone. The use of the Kettle river sandstone for building purposes is widespread. A brownish red sandstone is quarried at Fond du Lac, near Duluth, in St. Louis county. At Jordan, Scott county, a light colored sandstone is quarried.

The limestone quarried in southeastern Minnesota is mostly of two geological ages. The older is high in magnesium but the younger is comparatively pure calcium carbonate. The beds of each sort are horizontal and range in thickness from a few inches up to two feet. The stone is usually blue when fresh but turns to a buff on exposure. It is quarried at Kasota and Mankato for building stone and for natural cement; at other places for crushed stone and lime manufacture. Along the Mississippi it is used extensively for riprap.

The Mankato and Kasota quarries are in high grade magnesium limestone that can be tool faced, carved, and polished. The Mankato stone is of a buff color, and that at Kasota is of a light pink shade. That at Mankato is used largely for massive masonry and crushed stone. The Kasota stone is used for flagging and building purposes, such as polished wainscoting. Much of the wainscoting of the new capitol at St. Paul is of polished Kasota stone.

Limestone quarries are opened also at Rochester, Mantorville, Faribault, and Minneapolis. Most of the stone taken out in these quarries is used in the form of rubble and crushed rock. Lime is burned from local stone in Blue Earth, Fillmore, Goodhue, Mower, Rice and Scott counties.

The output of stone in Minnesota for the year 1912 was as follows: Granite, \$950,000; limestone, \$546,000, and sandstone, \$349,000. These totaled \$1,845,000. Minnesota ranked twelfth as a stone producing state in that year.

MINNESOTA

LAND VALUES

In 1910 the average value of land in Minnesota was \$46 per acre; in Iowa it was \$95.96 per acre, and in Illinois \$108.13, more than twice as much, in each case, as in Minnesota. At these prices, 160 acres—which in Iowa would cost \$15,360, and in Illinois \$17,280—could be bought in Minnesota for \$7,360.

THE DEVELOPMENT OF THE LUMBER INDUSTRY IN MINNESOTA

By E. G. Cheyney
University of Minnesota

WHEN the Pilgrims landed in Massachusetts in 1620 they encountered a forest running down almost to the very water's edge, and extending far back into the unknown interior. Coast as they would along the sea and up the rivers, the forest was everywhere ahead of them. Every acre of ground needed for their modest homes and tiny fields had to be wrested from the forests by ceaseless labor and from that same forest came their enemies,—wild animals and Indians. It became for the time the dragon guarding the apples of the Hesperides. It had to be destroyed that the people might live.

Ever mindful of the possibilities of trade, these early Yankees began shipping the choicest timbers to England, and thus began the logging industry in America. It was a small beginning for the ships were few and far between, but it grew apace as colonists rapidly increased in numbers and concentrated in towns where each man could no longer cut all the timber he needed in his own backyard.

For a hundred years these people lived on the Atlantic Coast literally hewing an empire out of the forest. They had prospered and multiplied beyond all belief. There was no longer any question of their ability to hold their own against the forests; they were completely master of the situation and were seeking new fields to conquer. Irresistibly they forced their way over the mountains and came in due course of time to the pine forests of Michigan. The hardwood forests were for settlement, but the forests of pine were to log, and among those hardy pioneers were experienced loggers trained in the forests of Maine. No one knew better than they the wonders of that forest.

Only one thing was lacking, a market; there were not enough people on the western side of the mountains to buy the lumber. This could not long hinder such ardent enterprise and the industry was triumphantly opened with the successful rafting of logs to the distant settlement of St. Louis on the far away Mississippi. Inevitably lumbering became the leading industry of Michigan, as it has been in turn the leading industry of every forested state in the Union.

THE EARLY LUMBER INDUSTRY

Settlement swept on to the westward, and two hundred years after the first white men had landed on Plymouth Rock the first wavelets of the great tide of civilization were lapping the southern half of Minnesota. In 1821 Fort Snelling was built at the junction of the Minnesota and the Mississippi, and to supply the timbers for this Fort, the first sawmill was built in the state at St. Anthony Falls; the logs were cut in the Dutchman's Grove and on the lower Rum River. This, however, must be considered as a purely sporadic

development, for the settlement of the state did not begin in earnest until the Chippewa Indians ceded that portion of the state east of the Mississippi River to the government in 1837. Once that settlement was begun the lumber industry took the lead as a matter of course. No sooner were the preliminary negotiations for the cession of the triangle of land between the Mississippi and the St. Croix under way than the first land seekers made their way up as far as the falls of the St. Croix, and located a site for a sawmill at Marine. A sawmill and all the necessary equipment was brought up on a chartered boat from St. Louis and the first lumber was sawn August 24th, 1839. This was the first commercial sawmill in Minnesota. It was a small waterpower mill with crude machinery and a capacity that would be put to shame by many of the portable mills of today; but it prospered and continued to operate uninterruptedly for fifty years, during which time it manufactured a total of 197,000,000 board feet of lumber.

Five years later, 1844, the first sawmill started operations at Stillwater which quickly developed into the leading lumber town of Minnesota. In fact it was generally considered at that time that Stillwater was destined to be the largest city in this section of the country. In the next ten years five more mills were built in and immediately around the town.

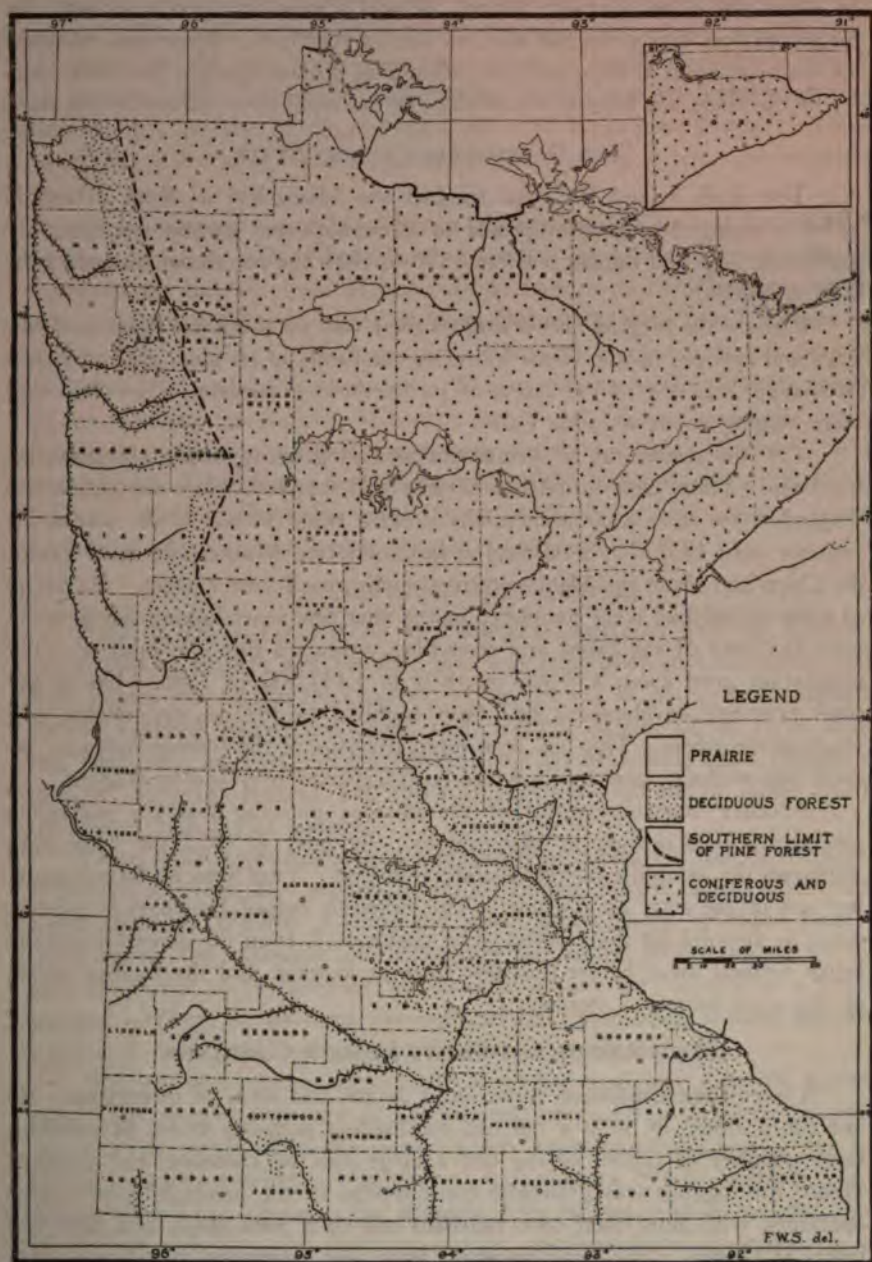
Obviously there was a market for comparatively little of this lumber in Minnesota, for the total population in 1850 was little over 6000. But in 1843 an accident pointed the way to a tremendous increase in the logging industry of Minnesota. The great log boom at Stillwater broke, and the whole winter's cut of logs was scattered down the Mississippi River as far as St. Louis. This was the beginning of the great log rafting on the Mississippi that leads to the development of sawmills at Red Wing, Wabasha, Winona, Dubuque, Galena, St. Louis, and many other points on the river. Practically all of them were supplied with logs from the upper Mississippi and St. Croix valleys.

THE BEGINNING OF MINNEAPOLIS AS A LUMBER CENTER

Thus it was that logging and milling was a well established business in the St. Croix valley when Mr. Franklyn Steele, who held the claim which controlled the waterpower at the Falls of St. Anthony,—the present site of the Minneapolis flour mills—built a sawmill in 1848 to tap the pine forests of the upper Mississippi. It was a rather precarious undertaking, for this section was yet in the hands of the Indians, and each operator had to bargain with them for the timber he wanted to cut.

The nearest large body of pine was found at the Rum River near Princeton in 1847, but the logs cut were lost in the Mississippi by the breaking of the boom. The next winter, 1848, the first logs to be sawn at the first Minneapolis mill were cut at the mouth of the Crow Wing. The timber was bought from Chief Hole-In-The-Day for 50c per tree.

So rapidly did the logging in this section develop that the $1\frac{1}{2}$ million feet cut the first year had increased to nearly 9 million in 1851 and to 44



Map of Minnesota Showing Distribution of Forest and Prairie.
(From Bulletin 12, Minnesota Geological Survey)

million in 1857. Logs became the medium of exchange. Merchants in St. Paul and St. Anthony Falls—which later became Minneapolis—supplied the mills and logging crews and accepted logs in payment. These they rafted to

St. Louis and other southern towns. It was a long time credit account, for the money was very often not received until a year later. Everyone, whatever his business, dealt in logs, and the millions of dollars brought into this country by the trade was largely responsible for the rapid development of the state.

THE DEVELOPMENT OF THE STATE

The Rock Island Railroad reached the Mississippi at Rock Island in 1854, bringing thousands of people to Minnesota and greatly enlarging the market for logs and lumber. From 1850 to 1856 the population jumped from 6000 to 100,000.

Rapidly the logging crews worked their way up the Rum River to Mille Lacs and beyond, up the Crow Wing to the limits of its pine, and on up the Mississippi and out to the limits of its northern tributaries. By 1860 they were logging north of Little Falls.

Yet, the settlement of Minnesota was progressing under a tremendous handicap. There were no railroads. For half the year, while navigation was suspended, the state was commercially isolated from the rest of the world. It was not until 1867 that a railroad at last connected Minneapolis with Prairie du Chien and made the Minnesota metropolis an all year market. Hundreds of miles of railroad were completed in the next few years linking Minneapolis with the head of the lakes, and stretching westward into the prairies. The population grew from 439,000 in 1870 to 1,117,000 in 1885. Up to this time extensive development had been confined to the country within easy reach of the rivers. This had been especially true of the lumber industry, because the products were too bulky to be transported overland by wagon.

Another important result of the railroad building was the marvelous growth of flour milling in Minneapolis. As early as 1875 the flour mills displaced the sawmills as the leading industry. That was in Minneapolis, but not in the state as a whole. The railroads helped the loggers quite as much as they did the flour mills. The timber back from the driveable streams began to melt away before this new form of logging, and the lumber output of the state increased steadily.

THE RISE OF THE GREAT LUMBER COMPANIES

Under these conditions there could be but one form of ownership. No one could afford to build a railroad for logging purposes unless he owned a large quantity of timber to log and a large mill to consume the product. Hence the logging was gradually concentrated in the hands of a few large operators, who build their own railroads and their own mills, and own vast tracts of timber. The small operator, with few exceptions, has disappeared; either left the country or is working under contract for the larger companies.

There was, however, one class of operators too small to be affected by these changed conditions, in fact it has thriven and has been increased by them. These were the *portable mill* owners. The large operators with their elaborate equipment have cleared large tracts of land and in the clearing of

these tracts have, for one reason and another, left small isolated patches of timber. Too small to support a permanent mill and located at prohibitive distances from the large mills, these patches can be handled profitably only by the portable mill. Moreover, much timber which was not considered merchantable at the time of the big operation now has a good market. Consequently we find almost countless portable mills working in what are known as cut-over lands.

The lumber output of Minneapolis had reached 678 million feet in 1899, but the bulk of the milling had already passed to the northern towns. The extension of the railroad from Minneapolis to Duluth in 1870 had boomed the latter, and a sawmill was started in West Duluth the same year. Others followed. The logging in Michigan and Wisconsin reached a climax between 1890 and 1900 and declined rapidly. This opened an inviting market for the timber tributary to Duluth. Chicago and North Tonawanda—the largest distributing point for the East—were both within easy reach by water. Millions of feet of Minnesota lumber passed out this gateway to the "Soo" and beyond. Most of the mills within reach of the lakes still saw a certain amount of full thickness lumber for this cargo trade.

THE NORTHERN MILL CENTERS

Falls in the St. Louis River at Thompson interfered with the free driving of logs to Duluth and the first mill was established in Cloquet in 1878. Four others followed in later years. When the cut of Minneapolis began to decline, Cloquet became the largest manufacturer of pine in the state, and it still holds that position. A logging railroad has been built from Cloquet to the Iron Range at Hornby, and this road together with the St. Louis and its tributaries, taps a vast country.

Other mills appeared as opportunity offered along the line of the Great Northern Railroad at Carleton, Scanlon, Grand Rapids, Deer River, Cass Lake, Bemidji, Walker, Akeley, and many other places. Around most of these centers the settlement of the country has lagged so far behind the logging that most of the product was shipped out of the country to a distant market. Where agricultural development has come later, lumber has been shipped in from some more distant frontier to supply its needs.

There is still another section which has had a slightly different development; the country tributary to the streams which empty into the boundary waters to the north. It is this section which is now supplying most of the logs to the present sawmills. A portion of it is reached by the railroads. The mammoth mill at Virginia, for instance,—the largest mill in the state, gets its logs by rail from this northern section, and distributes its lumber in the same way to all parts of the country. Other mills at Baudette, Spooner, and International Falls draw their supplies from this section, down the rivers as well as by rail.

THE PULP AND PAPER MILLS

A large supply of spruce and balsam in the northern part of the state at-

tracted another industry, closely allied to the lumber industry and yet different from it, the pulp and paper mill. The big sawmill with its insatiable appetite is essentially of a temporary character. It is impossible to keep it economically supplied with logs for a long period of years. Moreover it represents a comparatively small capital. The paper mill on the other hand usually represents a very large investment and can be supplied with wood in perpetuity from a comparatively small tract under the proper management. The manufactured product is compact, free from waste, and consequently can be shipped for long distances.

Under these conditions paper mills grew up at Cloquet, Grand Rapids, Brainerd, Sartell, and International Falls. Most of the mills grind up the wood and manufacture what is known as mechanical pulp, such as is used for the cheaper grades of print paper; but at International Falls and Cloquet sulphite mills have recently been installed for the manufacture of chemical pulp for high-grade papers. Spruce is the chief species used by these mills now, with a certain percentage of balsam mixed in, but the chemical mills are capable of using other species.

LOGGING METHODS

In some cases where the railroad has not penetrated and the timber is located near the stream, the logging methods have changed very little since the first logs were taken out in 1838, except that the saw has replaced the axe in felling the trees and the horses have crowded out the oxen on the sleigh hauls. It is what is known as the "snowball" system. The trees are felled and trimmed. The front end of the logs are chained on a single bobsled and with the rear ends dragging on the ground, are dragged to the stream, there to wait the spring break-up. As the haul from the woods to the stream increased, it was necessary to find some method by which the larger logs could be handled. The iced road was the solution. By sprinkling, the sleigh ruts were converted into grooves of ice, and by supporting the whole log on double sleds the loads were trebled, and in many cases more than that.

This is the method in almost universal use in Minnesota today. In a few cases where the railroad can be easily built and the stand of timber is particularly heavy, the overhead steam skidder in common use in the South, has been introduced in the past five years. It consists of a heavy cable stretched between two large trees for 900 ft. On this is an inverted bicycle like that used to carry the cash baskets in the stores. A lighter cable passing through this bicycle is operated by a stationary engine on a flat car. The logs are picked up by the cable wherever they are felled and carried to the cars for shipment to the mill. This method has proven very satisfactory under the present conditions, but can be used only on large scale operations where the timber is heavy.

THE FORESTS OF MINNESOTA

The original forest area of Minnesota has been estimated at 33 million acres. This included the Big Woods, or hard wood forest which extended

south from the mouth of the Crow Wing to the southern boundary and west to the prairies, and the pine forests which were scattered over the northern two-thirds of the state east of the prairies. This is ten per cent larger than the estimated forest area of Michigan and almost 30 per cent larger than that of Wisconsin. But the stand of timber is not so good and the total output of lumber from this state will never equal that from either of the other two.

THE HARD WOOD FORESTS

The Big Woods have furnished comparatively little timber to the lumber industry. Hardwoods are used more for specialties, and the market for them is not developed in a new country until the settlement is pretty well established. In the case of Minnesota, a large portion of this land was cleared for farming long before there was any market, and the timber was burned to get rid of it. To be sure there is a considerable portion of this section still under timber, but it is in very small patches, and most of it has been heavily culled of its most valuable trees for local purposes. What little of it now reaches the market does so through manufacturing plants which turn out finished products, and not through the sawmills. On the whole, it may be said that it never has and never will support a lumber industry worthy of the name, and so deserves little more than an honorable mention in this article.

THE PINERIES

It is the great pineries of the north with which we are chiefly concerned. Coming down to meet the Big Woods north of the cities, they covered the whole of the northern end of the state east of the prairies. The great bulk of it was a mixture of white and Norway pine. Almost everywhere there was some jack pine mingled with it, and this percentage increased on the sandier lands until the jack pine occasionally formed the bulk of the stand or even formed a pure stand itself on limited areas. Almost everywhere there was a sprinkling of the northern hardwoods, such as birch and popple, and these in turn on the heavier soils alone, mixed with other more valuable hardwoods, or, in the more northern counties, mixed with the spruce and balsam, occupied the ground to the exclusion of the pines.

Minnesota's lumber output reached its highest point in 1905, with about two billion feet, and has since then steadily declined. So rapidly and mightily did her lumber industry grow that just sixty-seven years after the first commercial sawmill had been built within her borders her "inexhaustible timber supply" was on the wane. Never again will the industry attain to the proportions it had in 1905; but, on the other hand, never will it die out. New and possibly inferior species will be forced into use, while the second crop of pine is growing to merchantable size, but a lumber industry there will always be. Part of it at least, the manufacture of paper and pulp, is likely to increase steadily, and, in time, take a prominent place in the industries of the state.

AGRICULTURE IN MINNESOTA

By Geo. J. Miller

State Normal School, Mankato

AGRICULTURE is the most important single industry in Minnesota. Suitable climate and suitable soil are two essential requirements for agriculture. Other factors influence the rapidity and intensiveness of development in a given region, especially such factors as transportation facilities and

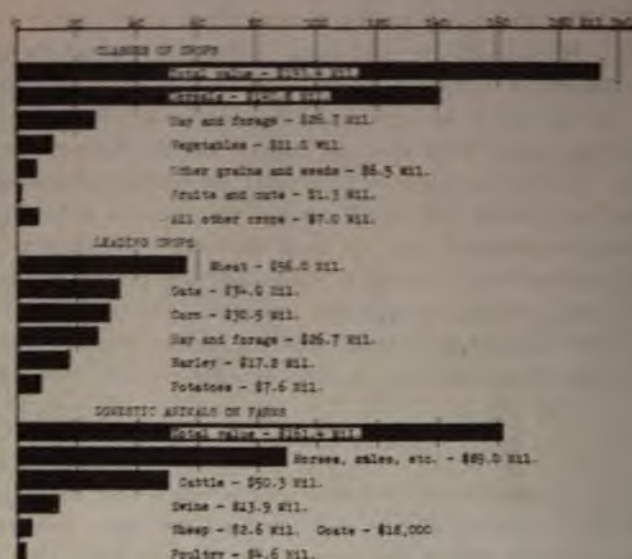


Fig. 1. Summary of Minnesota Agriculture for 1909.

markets. All the above factors, the dairy industry, and horticulture are considered in other articles, hence this discussion is limited more particularly to a brief summary of the leading crops and agriculture as a whole.

AGRICULTURE IN GENERAL

The general distribution of agriculture in the State is presented clearly by Figures 2, 3, 4, and 5, which show the distribution of the value of farm property; of all crops; number of all live stock on farms; and the percentage of land area in farms. It is evident that the most highly developed parts of the State are the southern half and the northwestern or Red River Valley section. The northeastern part is developed but partially, large portions being wholly undeveloped agriculturally. The southern section corresponds to the grey drift and prairie soils, the northwestern section to the lacustrine soils of Lake Agassiz, and both sections correspond to the more favorable climate of the State. The northeastern section includes the forest and cut-over lands,

light or rocky soils, and extensive swamp areas. The level land, rich soils, and favorable climate of the Red River Valley offered excellent opportunities for the growth of cereals, especially wheat, and was settled early in the history of the State. Only within recent years has agriculture become more diversified in that region. The advanced development in the northern half is

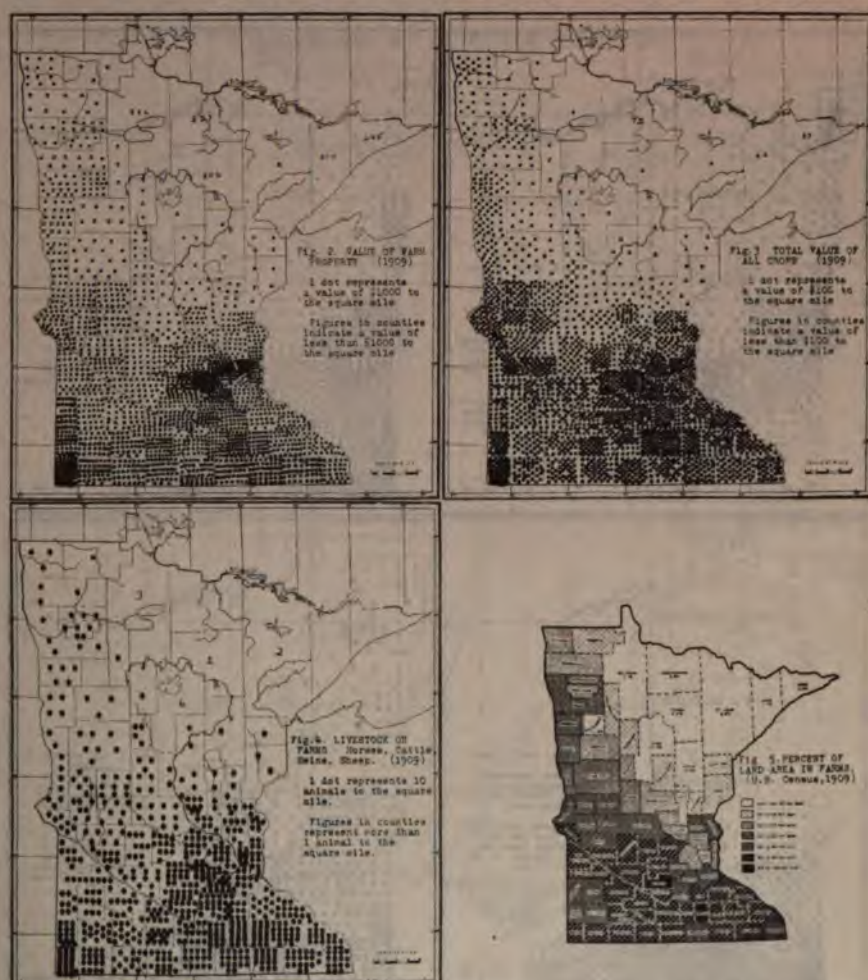


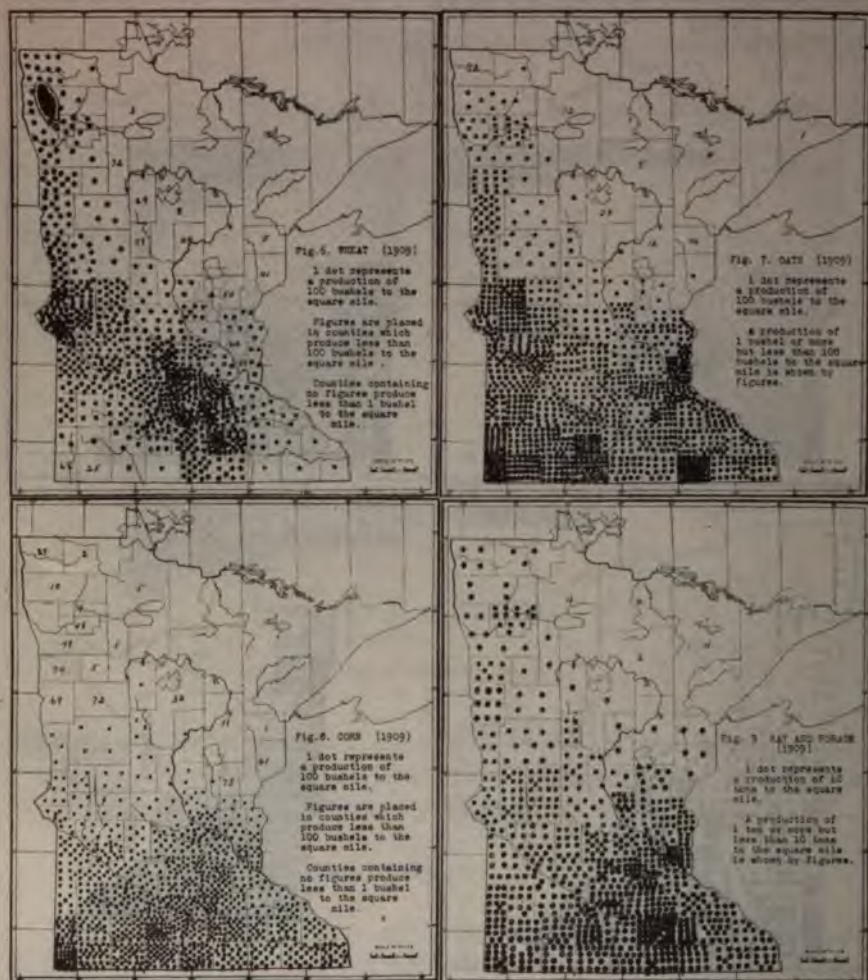
Fig. 7. Figures showing important agricultural statistics for Minnesota.

due in part to the fact that it was settled first and to the easy occupation and cultivation of the open prairies after they were opened to settlement. The poorer soils and forest covered portion in the northeast was passed by until the more desirable areas elsewhere were occupied.

The importance of the southern portion of the State is made evident by comparison with the State as a whole. In the area south of a line drawn east from the southern end of Lake Traverse is produced 72.6 per cent of all crops, measured by value; it has 77.4 per cent of the value of all farm property; 77

per cent of the value of all live stock on farms; 71 per cent of the improved land in farms; 69.3 per cent of the total population and all cities (except Duluth) of more than 11,000 inhabitants.

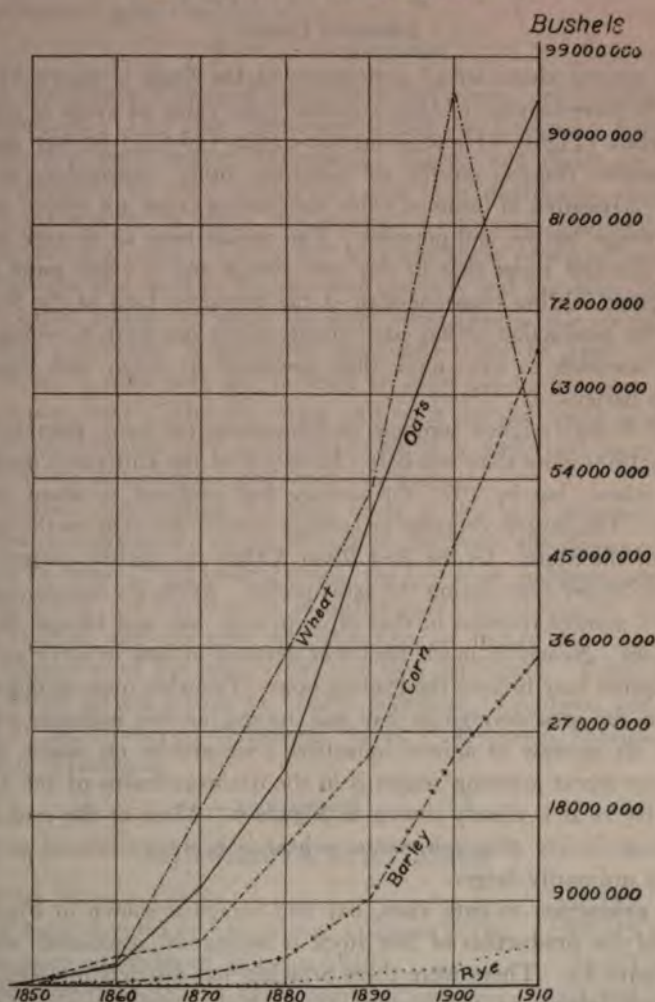
Cereals were the pioneer crop in southern Minnesota as in most newly settled regions of the United States. Wheat was the chief crop. During the



past decade and a half diversified farming has become more widespread with special emphasis upon live stock, the dairy industry, and the production of stock food. With diversified farming, increased population, better markets and transportation facilities, land values have increased greatly. This condition has stimulated settlement of the northeastern part of the State. During the decade 1900 to 1910, 55 per cent of the counties of southern Minnesota (south of the previously described line) declined in rural population, the decrease averaging nearly six per cent and varying from one-half of one per cent

to 12.4 per cent. Many of the people who left the farms of this section went to the cities, others left the State, while others sold their farms at the high prices prevailing and bought more land in the northeastern part. This section, therefore, has experienced the most rapid growth of any part of the State outside of the cities. Even with this rapid growth, however, the northeastern

PRODUCTION OF CEREALS, 1850-1910.



Production of principal cereals in Minnesota, 1850-1910. (From Robinson's "Economic History of Agriculture in Minnesota." University of Minnesota Studies in the Social Sciences, Number 3.)

part is very sparsely settled and much of it must always remain sparsely settled, because it is best adapted to forest culture. The State as a whole is only partially developed agriculturally. In the southern section 80 to 100 per cent

of the area is in farms, in the northwestern section 40 to 80 per cent, and in the northeastern section less than 40 per cent (Figure 5). Seventy-one per cent of the farm acreage is improved, which represents only 38 per cent of the land area of the State. Although the improved acreage is small compared with the entire area it is approximately equal to the land area of Connecticut, Massachusetts, Vermont, and New Jersey combined, and to more than one-fourth the area of the British Isles.

LEADING CROPS

The general character of agriculture of the State is shown by the fact that nearly three-fourths (72.8%) of the total value of crops is contributed by the cereals (Figure 1) and about one-eighth (13.8%) by hay and forage. The remainder consists mostly of potatoes, other vegetables, and forest products. Measured in terms of value the leading crops are wheat, oats, corn, hay and forage, barley, and potatoes. The cereals have an acreage more than two and one-half times that of hay and forage and a value more than five times as great. More than one-fifth of the improved land of the State is devoted to the production of hay and forage, about one-sixth to wheat, a little less than one-sixth to oats, more than one-tenth to corn, and nearly one-twelfth to barley.

King Wheat reigned supreme in Minnesota for more than forty years. As late as 1900 more than one-half (50.69%) of the cultivated land was devoted to wheat, but by 1910 the acreage had declined to about one-fourth (25.7%). The largest decrease in acreage was 95 per cent in the southwestern part of the State. In the Red River Valley the decline ranged from 30 per cent to 50 per cent during the same period. With the loss in wheat acreage came a marked increase in that of corn, oats, hay and forage, barley, rye, and potatoes. Nearly as much land was devoted to oats in 1910 as to wheat and the former may become the leading crop. Probably most significant is the increase in the area devoted to hay and forage, as this indicates rotation of crops and an increase of animal industries (See article on dairy industry). The present wheat growing region is in the drainage basins of the Minnesota and Red rivers as is clearly shown in Figure 6. Most of the crop is a high grade spring variety although winter wheat is being introduced as the yield per acre is ordinarily larger.

The production of oats, corn, hay and forage is shown in Figures 7, 8, and 9, and the production of live stock is intimately associated with these crops (Figure 4). There were three principal oat districts in 1910, viz., the high Coteau section in the southwest, the high plateau section of Mower County in the southeast, and about the Twin Cities. The development of the first two sections is probably due to the fact that oats give better yields than most other cereals where the nights are cool. Owing to the bulky character of oats the crop usually pays best near large city markets, which probably accounts for the development of the section about the Twin Cities. South-central and southwestern Minnesota are the more important corn sections. This

distribution is probably due to the cultivable character of the fertile soil, the spring and summer distribution of rain, the long hours of sunshine, the high summer temperatures, and the development of the live stock industries. Corn has been grown (1910) in all but two counties of the State but it remains to be demonstrated how far north it will be a profitable crop. With the abandonment of the single crop system of wheat production and the adoption of diversified agriculture the production of hay and forage has extended over the entire agricultural area.

ANIMAL INDUSTRIES

With the diversification of agriculture has come development of the animal industries. The more important sections as shown by Figure 4 are southeastern and southwestern Minnesota. Horses and mules are the most important measured by value (Figure 1) and their distribution bears a close relation to the number of farms, the amount of improved land, and the oats-and corn-growing sections. Cattle for beef are being produced especially in the southwestern and extreme southeastern districts and for dairy purposes in the south central region and about the large cities (See article on dairy industry). Swine production is intimately associated with the dairy industry as they are raised on skim milk and fattened on corn and barley, corn being the more important food. The dry, high and well drained grass lands of the southwestern and southeastern districts are the more important sheep areas although sheep are distributed throughout the State.

Conclusion.—An attempt has been made in this brief summary to indicate the general distribution of agriculture in the State, the classes of agricultural products, some of the leading crops, the live stock industry, some of the factors influencing the distribution of agriculture, the change in the character of agriculture, and the most probable lines of future development. A thorough discussion of the subject has not been attempted. Every school in the State should secure a copy of "Early Economic Conditions and the Development of Agriculture in Minnesota" by E. V. Robinson, published by the University of Minnesota.

MINNESOTA

MINNESOTA STATISTICS

Area of state (Census 1910)	51,749,120 acres
Number of acres devoted to agriculture (Census 1910)....	27,675,823 acres
Number of acres undeveloped (Census 1910).....	24,073,297 acres
Vacant government homestead lands open for entry.....	1,500,000 acres
Approximate amount of state lands unsold.....	2,800,000 acres
Number of farms in state (Census 1910).....	155,759
Average size of farms (Census 1910).....	177 acres
Value of farms and buildings (Census 1910).....	\$1,259,510,000
Average value per acre of farms and buildings (Census 1910).....	\$46
Value of live stock (Census 1910).....	\$161,527,793
Increase in land Values, 1900 to 1910, \$16 an acre.....	77%

NOTES ON THE GEOGRAPHY OF THE RED RIVER VALLEY

By Stephen S. Visher, Ph. D.

State Normal School, Moorhead, Minnesota

MINNESOTA'S most famous three possessions perhaps are the stupendous open-pit iron mines of the Mesabi Range; the enormous flour mills of Minneapolis; and the Red River Valley. The Red River Valley has been prominent for more than forty years. Its gigantic wheat harvests have contributed much towards making Minneapolis the greatest flour-milling city in the world; it has during the three decades preceding the last yielded perhaps more flax seed, as well as more wheat, than any other like area in the world; and its "bonanza" farms have been almost the type illustration of extensive farming operations.

LAKE AGASSIZ AND ITS EFFECTS

The Red River Valley is a lake plain rather than a river valley. It is part of the bed of glacial Lake Agassiz. This famous lake, when largest, extended nearly 700 miles north from Big Stone Lake, and embraced an area about one fifth larger than the combined areas of the present five Great Lakes. The existence of this vast lake is proven by the materials laid down on its bottom and by features produced along its margin. At some places, the waves cut low cliffs and terraces; along scores of miles of its shore they heaped up loose materials into beach ridges, parts of which subsequently were piled up by the wind into dunes. Deltas were formed where streams entered the lake.

Lake Agassiz came into existence when the glacier obstructed the normal drainage towards the north. The water rose in the basin until it overflowed to the south. When the melting of the glacier opened an outlet to the north lower than that through Big Stone Lake and the Minnesota River, the lake level fell from something like 1050 feet above sea-level to approximately 970 feet. With the disappearance of the glacier, the lake nearly disappeared. Lakes Winnipeg, Manitoba, Lake of the Woods, and several smaller ones may be looked upon as remnants for they occupy the deepest depressions in the old basin.

Lake Agassiz influenced in several ways the region it occupied. The Red River Valley owes to it the lacustrine silt, the upper few inches of which have weathered into very fertile soil. Much of the sediment brought into the lake was well sorted. In some deltas there are commercially valuable deposits of gravel and sand; from the one near Muskoda, about 18 miles east of Moorhead, tens of thousands of carloads have been taken. Although the margin of the lake plain is sandy in many places, little but fine material was carried far from shore; hence nearly all the more central part of the ancient lake is covered now by material very fine in texture, so fine, indeed, as to form, when water-soaked, an exceptionally sticky mud, locally called gumbo.

The flatness of most of the Red River Valley is remarkable. Professor

Davis states that the floor of Lake Agassiz is perhaps the largest almost flat area of agricultural land in the world. This flatness is in part due to the deposits which accumulated smoothly on the bottom of the ancient lake. The fewness and youth of the stream-valleys of this area have made the Fargo Quadrangle of the United States Topographic Atlas a favorite one for the study of the youthful stage of erosion. The briefness of the interval, only a few thousand years, which has elapsed since Lake Agassiz disappeared, is partly responsible for the character of the stream valleys. The thinness of the soil layer doubtless is another result of the same fact.

SOME RESULTS OF THE FLATNESS OF THE AREA

The evenness of the surface and the general absence of bowlders and of trees or large shrubs are favorable to the use of labor-saving farm machinery. Traction plows, which are much used, and other machinery, made more easy the development of vast or bonanza farms. The topography favors road and railroad construction and use. The accessibility of the gravel deposits of some of the ancient deltas favored the gravelling of the railroads and roads, but such improvement of the roads has been delayed because for more than half the year dirt roads are fairly satisfactory. This is especially true during the several months when they are continuously frozen.

The levelness of the surface, the paucity of valleys, and the silty nature of the materials, combine to favor the soaking-in of moisture and to hinder its run-off after rains or melting. Since evaporation is relatively slow, a response to the general coolness of the climate, and as the run-off is slight, the average rainfall, somewhat less than 25 inches, is abundantly sufficient for the crops grown. Indeed, in unusually rainy years some areas, especially those relatively distant from stream-valleys, need artificial drainage.

The levelness of the area, its low elevation above the sea, in most places less than 900 feet, and its position near the center of the continent, combine to make the rate at which this area is lowered by running water exceptionally slow. It has been authentically estimated that the average rate of lowering of surface for the United States is about one inch in 760 years, while in the Red River Valley, 3900 years are required.

CLIMATIC INFLUENCES

The climate as well as the soil, of the Red River Valley is suited to the growth of spring wheat, oats, barley, potatoes, rye and flax, the chief crops grown. In spite of the high latitude, much of the valley has a latitude of about 48° , and the low average temperature, approximately 38° F., these valuable crops are ripened during the short but almost tropically hot summer season of long days and short nights. The average July temperature is almost that of equatorial regions (70° F.). The fact that most of the precipitation falls during the growing season, when it is needed, is noteworthy. The shortness of the growing season is unfavorable to the production of corn or of fruits, but suitable varieties of these are being grown farther and far-

north, and corn already is important in the southern half of the valley. The long cold season discourages stock-raising, also, but it is conducive to social activities, reading and education.

HISTORICAL GEOGRAPHY

As the Red River Valley is not a part of the Mississippi drainage system, it was not included in the Louisiana Purchase, and did not become American territory until the Treaty of 1819 with Great Britain. Settlement had begun, however, near the present Canadian boundary, shortly after the beginning of the century, (1811). Steam-boats were run occasionally far up the river, but communication with the outside world was unsatisfactory until the coming of the railroads, and hence development was slow. For many years the chief mode of transportation between the settlements in the lower Red River Valley and the East, (Ft. Snelling, (1820-38), St. Paul, and later St. Cloud), was by means of picturesque but very cumbersome "Red River Carts." These crude, wooden, solid-wheeled vehicles were drawn by oxen.

With the coming of railroads, in the early 1870's, the development of the valley was rapid. By 1880, it was far more densely settled than most frontier regions. Upon its fertile plow-inviting soils, wheat crops often were raised, which yielded enormous profits until the price of wheat was forced down, by greatly increased production, from nearly or quite \$1.20 per bushel to little more than half that price. This great increase in production was due not alone to the development of the Red River Valley; it was contributed to by many areas, in other parts of the world, where recently perfected labor-saving machinery, including discs, reapers and steam threshers, and railroads were also being used extensively. The ease with which profitable yields of wheat were produced in the Red River Valley permitted it to continue to be a great wheat-raising area when regions less favored geographically were forced by the lower price of wheat largely to abandon wheat-raising.

The one-crop method of farming, long in vogue in the Red River Valley, is being abandoned under pressure of increased value of the land, (an inevitable result of increased demands for land by the augmented population), of greater realization that diversification pays, and, in some sections, by the decreased yields following many years of careless wheat-culture. Other grains, especially oats, barley, and rye, were first extensively grown. Corn, in the southern sections, and potatoes more widely, have had greatly increased importance of recent years, chiefly because land which has been so tilled, yields the next year often nearly twice the average crop of wheat. The corn is mostly used as fodder for the rapidly growing herds. Many silos have been built lately. Potatoes are produced almost exclusively with the help of much labor-saving machinery. It is said that they may be raised profitably in rotation with wheat when the price is as low as 25c per bushel. When the price is two or even three times that great, as it sometimes is, the profits are large.

POSSIBLE FUTURE DEVELOPMENTS

It is likely that in the future, development in the Red River Valley will

continue along lines already followed; diversification of activities will proceed apace. The large farms will be cut up; live stock will be reared more generally; rotation of crops will be carried on more and more commonly; a number of crops such as alfalfa, root-crops, and vegetables not yet of importance, will become important; tillage will be increasingly thorough, and areas requiring it will be drained. Manufacturing is increasing rapidly in the cities of the Valley. It is likely to increase until a large share of the local demands for certain commodities will be supplied by local production. The production of such articles as flour, preserved vegetables and meats for which the raw materials are, or may well be, produced locally, and of various articles for which the transportation charges are much higher for the manufactured article than for the partly fabricated or raw materials, is to be expected. It is likely that many local manufacturing plants will be especially active during the long cold season, when out-door work is discouraged and when labor is cheapest.

Thus the Red River Valley is likely to lose some of the characteristics for which it has been famous. However, for geographic reasons, it is likely to continue to be an important wheat-growing region and an area in which farming on a large scale with the help of traction-engines and other labor-saving machinery is common.

—MINNESOTA—

SOIL MAPS OF MINNESOTA

By F. J. Alway

Chief of Division of Soils, Minnesota Agricultural Experiment Station

SEVERAL so-called soil maps of the whole state of Minnesota are on the market, but these either show so little detail or are so incorrect as to make them quite valueless. The only reliable maps are those published by the State Geological Survey and by the Bureau of Soils of the U. S. Department of Agriculture. A map of the northwest quarter of the state, on the scale of eight miles to the inch, has recently been published by the former, and five counties and parts of three others have been surveyed by the latter.

The map of the northwestern quarter, together with the accompanying report (Bulletin No. 12 of the Minnesota Geological Survey) may be obtained by remitting 25c to the Librarian of the University of Minnesota, Minneapolis.

A similar report with a map on the same scale for the northeastern quarter of the state is now in course of preparation. These two maps, which are based upon the drift survey of the state by Mr. Frank Leverett of the U. S. Geological Survey, show the general character of the soils of the different counties, but do not indicate the nature of the soil on the individual sections. The scale used is so small as to cause a quarter-section to appear on the map as a mere dot. As the report already published includes chapters on the climate, topography and glacial features of the whole state it will be

terest and value to teachers in all parts of Minnesota, but especially to those in the surveyed counties: Becker, Beltrami, Clay, Clearwater, Hubbard, Kittson, Mahanomen, Marshall, Norman, Polk, Pennington, Red Lake and Roseau, and the adjacent parts of Cass, Crow Wing, Koochiching, Ottertail, Wadena and Wilkins.

The maps prepared by the Bureau of Soils may be secured by writing your member in Congress. Those already published include the following counties or parts of counties: Blue Earth, Goodhue and Rice; Carlton (in part) Crookston Area (southwest part of Polk) and Marshall Area (central part of Lyon). Pennington and Ramsey counties have been surveyed but the reports are not yet published. On these a scale of one mile to the inch is used which is sufficient to show on individual quarter sections the various soil types when these occur in areas of less than 10 acres.

No soil survey work is being conducted in the state at the present time. Beginning with 1915, the U. S. Department of Agriculture discontinued soil survey work in all states which do not contribute to the expense of the work. A bill introduced in the last Minnesota legislature providing an appropriation for soil survey work failed to pass. It is hoped that the next legislature will make an appropriation so as to permit of cooperation with the U. S. Bureau of Soils in the continuation of the detailed survey of individual counties.

MINNESOTA

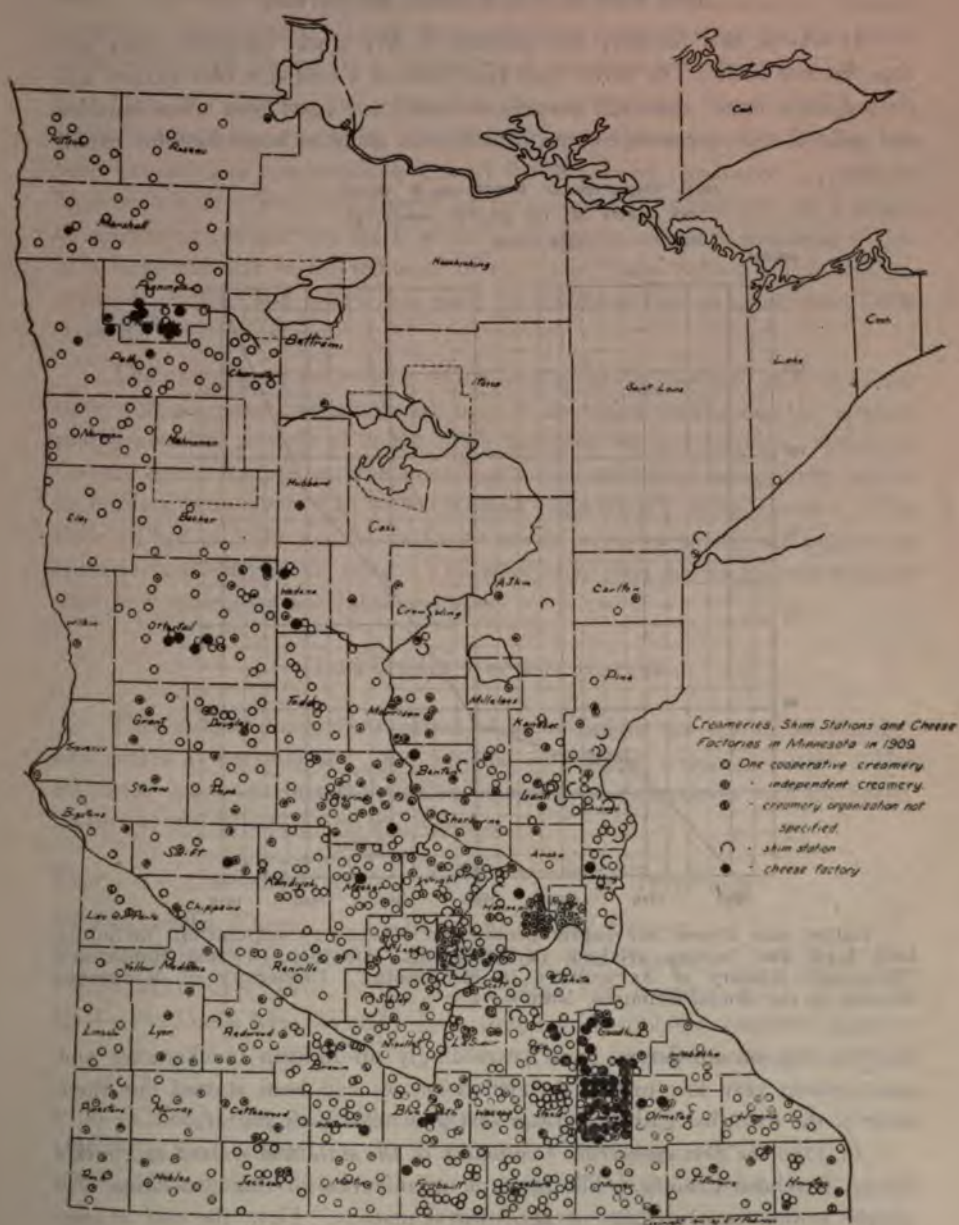
DAIRYING IN MINNESOTA

By R. M. Washburn

University of Minnesota

IN the matter of production of butter and cheese, Minnesota ranks third in the United States, following Wisconsin and New York. Every state may be said to be possessed of certain advantages for certain crops; and the production of wheat, oats, and flax were the crops which the fertile soil, abundant rain-fall, and comparatively level land of Minnesota encouraged.

The fertile, rolling fields of southern Minnesota were settled in the late 40's and the 50's, and wheat at once became the chief and almost only crop raised. So great was the production of this single crop that at one time the little city of Red Wing was said to be the largest primary wheat market of the world. The constant draught upon the soil, however, began to show its effects as early as 1870, and became pronounced by 1890, even though new fields had been brought under the plow. The central and western portions of the state were settled at a little later period but followed largely the lead of the farmers farther south. The immense quantities of small grains produced soon began to tell upon the fertility to such an extent as to cause some alarm. It was evident that a more rational system of farming was necessary. At this time, about 1890, by far the majority of the farms were mortgaged heavily.

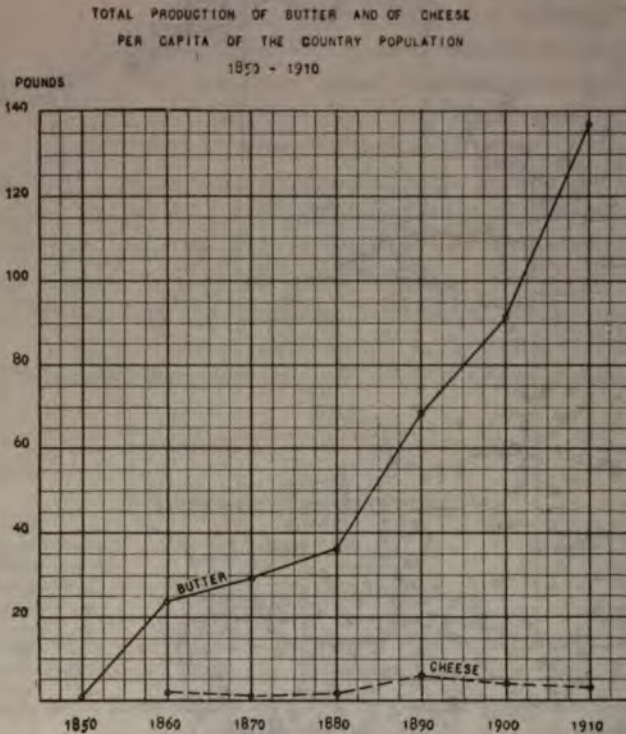


Distribution and organization of creameries, skim stations, and cheese factories in Minnesota in 1909. (From Robinson's "Economic History of Agriculture in Minnesota." University of Minnesota Studies in the Social Science Number 3.)

Then, to make matters yet worse, the chinch bug appeared with its devastating attacks.

THE RISE OF THE ANIMAL INDUSTRIES

It was at this juncture that interest in live stock, especially cows and hogs, became keen. The cattle then kept were of a mediocre beef variety and yielded little better than 125 pounds of butter per year, even when handled and milked with reasonable care. Butter was made at home to some extent



Butter and cheese per capita production of country population, including both farm and factory product, in Minnesota, 1850-1910. (From Robinson's "Economic History of Agriculture in Minnesota." University of Minnesota Studies in the Social Sciences, Number 3.)

but this was of indifferent grade, exceedingly un-uniform in character and commanding very low price. A few creameries had been started but these were of the so called gathered-cream sort and made poor butter.

In 1890 the first co-operative creamery of the state was started at Clark's Grove, Freeborn County. The form of organization of this association was unique at that time in dairy or agricultural matters. First, the cost of construction of the plant was paid from a sinking fund made up by withholding a fraction of a cent per pound of butter from each and every patron delivering milk to the plant, thus the cost was pro-rated against the farmers according to benefit received. Second, the distribution of all surplus was made pro-rata

according to patronage, thus encouraging production. Third, each man owning stock in the company had but one vote regardless of the number of shares held. This was done to discourage any individual endeavoring to acquire control of the business. These three principles have stood as the foundation upon which 625 co-operative creameries of the state have been built.

Once the practicability of the co-operative creamery was demonstrated, growth in dairying was rapid. From the start the growth of the industry has been natural, and comparatively few of the ill-advised "promoted" creameries have been built. Both the growth of the co-operative creameries on a sound co-operative basis and the check of the over-zealous creamery promoter is due in a large measure to the influence of the State Dairy School which was organized in 1892 and which has since given instruction to more than 2000 students.

The majority of the creameries are located in the southern portion of the state, though prosperous plants are now in operation throughout the western prairie counties as well as in the more northern wooded sections. Ottertail County leads the state in total number of creameries, there being thirty within its borders, with more than \$900,000 paid out annually to its farmers. The little village of Milaca in Mille Lacs County boasts of having the largest co-operative creamery in the state. This association pays out to the surrounding producers more than \$300,000 annually.

HIGH QUALITY OF THE BUTTER

This state is particularly proud of its record in the matter of winning first prizes at national and inter-national contests in creamery butter. The following is a list to date of the prizes won in open competition with the butter makers of the United States and Canada:

<i>Year</i>	<i>Convention held</i>	<i>Prize won</i>
1899	Topeka, Kansas, N. C. B. A.,	\$100, Silk Banner.
1901	St. Paul, Minn., N. C. B. A.,	\$100, Silk Banner.
1902	Milwaukee, Wis., N. C. B. A.,	\$100, Silk Banner.
1904	St. Louis, Mo., World's Fair,	grand prize diploma, awarded state or country with largest percentage of scores of 95 or better.
1906	Chicago, Ill., N. C. B. A.,	\$100, Silk Banner.
1908	St. Paul, Minn., N. C. B. A.,	\$100, Silk Banner.
1909	Milwaukee, Wis., N. C. B. A.,	\$100, Silk Banner; 96.53, average of ten highest entries from state; 95.86, Wisconsin, next highest.
1910	Chicago, Ill., N. C. B. A.,	\$100, Silk Banner; 95.86 average of ten highest entries from state; 95.69, Wisconsin, next highest.

- 1911—Chicago, Ill., N. C. B. A., \$100, Silk Banner; 96.53, average of ten highest entries from state; 95.86, Wisconsin next highest.
- 1911—Milwaukee, Wis., International Dairy Show, silver loving cup; highest average of twenty highest entries.
- 1912—Milwaukee, Wis., International Dairy Show, silver loving cup; highest average of 15 per cent of creameries of state.
- 1913—Chicago, Ill., N. C. B. A., \$100, Silk Banner; 96.248, average of ten highest entries from state; 95.68, Iowa, next highest.
- 1914—No contest held.
- 1915—Mason City, Iowa, N. C. B. A., \$100, Silk Banner. Score 95.55; Iowa next highest, 94.92.

It should further be explained that there have been in all only fifteen contests of a national or inter-national nature, and that the grand championship prize has come to Minnesota in thirteen of them. And, as a matter of fact, it was Minnesota-trained men who carried off the honors for another state on one of the two occasions when Minnesota lost.

The 1913 legislature provided that under certain conditions creameries might stamp their butter with the name "Minnesota." There are now twelve "state brand" creameries which have fulfilled the 13 rigid requirements for A-1 Grade, and the 11 requirements for B Grade.

The likelihood of our continuing to win the national grand championship prize increases with the number of creameries qualifying under the "state brand."

CHEESE FACTORIES AND CONDENSARIES

A cheese factory to be profitable requires only about one-fifth as many cows and one-fifth as much capital as a creamery, and for this reason cheese factories were built very largely during the earlier days of dairy development. For various reasons, however, chief among which was the cost of delivering the large quantities of sweet milk to the factory daily for cheese making, the majority of these plants have been converted into butter-making establishments, until there are now only seventy-two cheese factories in the state. These, however, are well established, doing good business and in every way demonstrating their right to be. The number is slowly increasing.

There had never been a condensed milk factory in the state until quite recently and there are but 4 at the present time. There are likewise two plants equipped for the making of dry milk or milk flour.

THE SPREAD OF DAIRYING AND ITS VALUE TO THE STATE

The northern portion of the state, once so heavily wooded and later thought to be of little value, is now developing most rapidly into prosperous agricultural communities, and this is very largely due to the use of the dairy

cow and the manufacture of her product in the co-operative creameries. The comparatively cheap land of the northern counties will produce nearly, if not quite as much profit when pastured to cows as will the farms of the southern counties valued at three to six times as much per acre.

The short-horn was the first distinctive breed of cattle to gain prominence in the state and there are still a larger number of grades of this breed than any other. The distinctive dairy breeds are, however, increasing more rapidly in number than are the beef breeds. The Holstein-Friesian, the Guernsey, the Jersey, and the Ayershire are increasing in number most rapidly in the order named, and with their increase in number a marked improvement is noticed in the average yield of the cows of the state, the present average being about 175 pounds of butter per cow per year.

The creamery butter and factory-made cheese in Minnesota amounts to more than \$38,000,000 per year, a sum nearly one-third greater than the total out-put of gold from Mexico under normal conditions, and nearly one-half as great as the total gold out-put of the United States including Alaska, while the total value of dairy products in Minnesota is about \$96,000,000.00 annually. The production of butter may be said to be a perpetual gold mine, since the ingredients of which butter is made are of the cheapest on the farm. The manufacture and sale of butter feeds humanity without impoverishing the farm from which it was derived and is in a true sense a creative industry and one worthy of even more encouragement than it has received in the past.

MINNESOTA

FRUIT GROWING IN MINNESOTA

By Le Roy Cady
University of Minnesota

THE varied soil and climatic conditions in Minnesota makes possible the growing of most of the small fruits, such as strawberries, raspberries, currants, gooseberries, blackberries and many varieties of apples and plums generally throughout the state. Cherries are grown to advantage only in the southeastern part of the state, and even here are not always a paying crop. Apples are grown in large quantities in the southern half of the state and may be grown in quantities for home use in almost any part of the state if the right sorts are selected.

Apples.—The principal fruit districts at present are the district about Lake Minnetonka and the southeast quarter of the state. These sections produce as nice Wealthy, Patten, and Northwestern Greening as can be raised in the United States. Apples seem to do best on rolling land, often land along the lakes and rivers that cannot be used to advantage for other crops. An open clay subsoil and a northeast slope gives the best apples.

Plums of native origin do well throughout the state generally. The Japanese and European sorts may be grown in favored places, such as along

the river in eastern Minnesota and about the larger lakes, such as Minnetonka. The lakes and rivers of the state have a great influence on the fruit growing industry, since they tend to protect fruit and flowers from frosts at certain seasons to some extent. Plums are found wild in abundance in the timber sections of the state.

Berries.—Strawberries and raspberries among the small fruits may be grown anywhere in the state for home use, and in most places can be grown for market to advantage if there is a market near enough to take the fruit. Small fruits must be marketed near home for they will not stand shipment over long distances without the extra expense of icing and special care. So those expecting to market small fruits should live near a town having good shipping facilities and that is not too far from a good market.

The best strawberry and raspberry sections seem to be Lake Minnetonka, and about the large lakes of north central and southeastern Minnesota. Blackberries and dewberries may be grown under about the same conditions as raspberries, although they are a little more tender and more particular as to soil. Throughout Minnesota it seems the safest and best plan to lay down the raspberries and blackberries, covering with earth to prevent winter injury. Strawberries are usually protected by covering with a few inches of straw. This helps to prevent freezing and thawing in winter and helps to hold the foliage over to better advantage.

Many varieties of strawberries are grown, but among the best are Senator Dunlap, Bederwood, and Warfield. The autumn-bearing sorts are coming into notice now. They require about the same treatment as June fruiting sorts, except that all buds should be kept off up to about the first of July, when fruit in abundance may be expected from August until cold weather.

Currants and gooseberries can be grown in all parts of the state. They require good, rich, sandy loam and thorough cultivation for best results. Locations near large towns or where there are good shipping facilities are best for commercial currant-growing. As a home fruit they should be in every garden because of their ease of growing and fruit yields.

Grapes can be raised to advantage only about the larger bodies of water, such as Lake Minnetonka. A sunny, warm, well-drained location should be chosen. The south side of a hill is best. Many thousands of pounds of grapes were formerly grown in the state, but the cost of winter covering and pruning does not permit of competition with grapes from more favored sections of the United States.

Many *wild fruits* are found in the state. *Cranberries* are abundant in many of the marshes in the northeastern section of the state and it is quite likely that in time companies will be formed to raise them on a commercial scale. Other forms of wild fruit are highbush cranberries, black haw, wild cherries, plums, raspberries and blackberries. All are grown in the timbered sections of the state. Thousands of acres of the *blueberry* are found in the

northern part of the state. These are gathered in large quantities both by the settlers and Indians, and marketed.

While the *nut industry* of the state is not large, it has some importance in the southeastern section of the state, where black walnut and hickory are quite common. The butternut is grown in the timber sections up to the vicinity of Mille Lacs lake.

Nurseries.—The demand for planting stock of fruits and ornamentals has caused the establishment of about one hundred nurseries, located near the centers of population in the state. These vary in size from a part of an acre to two or three hundred acres of actual nursery stock. The largest nurseries are located about Minneapolis, Lake City and Owatonna.

Fruit Associations.—Much of the fruit is marketed through associations located in the fruit-growing centers. These associations handle, in good seasons, from a few hundred to fifty or sixty thousand dollars worth of fruit for their members, at a cost of about five per cent.

THE FLOWER INDUSTRY

The growing of flowers and ornamental plants commercially has increased greatly the last few years. Every town of any size either has a small greenhouse or looks to some nearby establishment for its supply of cut flowers. In the large cities there is a considerable sum of money invested in greenhouses and stock. Large quantities of chrysanthemums, carnations, roses, violets, and potted plants are grown for market. Thousands of bedding stock is grown and sold in the spring. The largest flower establishments are, of course, located in St. Paul and Minneapolis. There are also important establishments at Mankato, Owatonna, Albert Lea, and Austin.

Besides the greenhouse trade, there are thousands of dollars worth of flowering perennial plants sold from the nurseries, such as paeonies, iris, phlox, etc. Paeonies are grown for their cut flowers near the large cities. Dahlias and gladioli furnish large quantities of cut flowers to the flower markets each fall, sometimes, in fact, seriously competing with greenhouse-grown flowers. Asters and some other annuals are grown for early summer use both in the greenhouse and the field.

The following tables will give an idea of the quantity and value of the different fruits and vegetables in Minnesota according to the latest census, that of 1909:

	Acreage 1909	Bushels 1909	Value 1909
Potatoes	223,692	26,802,948	\$7,686,339
Onions	1,099		182,069
Cabbage	2,315		128,430
Dry Beans	4,697		124,996
Sweet Corn	2,829		62,387
Cucumbers	1,190		59,512

Tomatoes	449		52,631
Melons	453		41,913
	Acreage	Production	Value
	1909	in Quarts	
Strawberries	1,872	2,730,099	\$268,772
Raspberries	1,388	1,340,469	178,689
Currants		182,825	19,783
Blackberries		139,741	17,696
Gooseberries		60,661	6,412
Cranberries		22,112	1,981
Nurseries	3,854		\$863,014
Flowers under glass.....			603,935

MINNESOTA

GEOGRAPHIC INFLUENCES IN THE EXPLORATION AND EARLY DEVELOPMENT OF MINNESOTA

By C. J. Posey
University of Minnesota

SITUATED as Minnesota is at the geographic center of the continent it was natural that its settlement and development should come later than much of the country lying nearer the Atlantic seaboard. In the matter of its exploration, however, this region was pretty well known to the French nearly a century before the region west of the Appalachians was as well known to the English. Though there is lacking positive proof, yet it is possible that Radisson and Groseilliers were within the limits of this state in 1655, and very probably in 1659. But the first authentic record is that of the trip of the Sieur Duluth, in 1679, who, coming by the way of Lake Superior, went inland as far as Mille Lacs.¹

That knowledge of Minnesota was obtained relatively so early was due in part to the topography and drainage of the state. Here no great topographic barrier obstructed the path of the voyageur; instead here is a glacial plain studded with many lakes and crossed by many streams, and as a result passage from one river system to another usually required only a short portage. Here, further, three great river systems of the continent, the Mississippi, the St. Lawrence, and the Nelson-Red, have their sources, and they afforded easy access from three different directions. It is significant that the first two authentic exploring expeditions within the present borders of the state entered by two of these waterways, Duluth by the St. Lawrence and Hennepin by the Mississippi, and that the leaders should actually have met in the vicinity of Mille Lacs in 1680. Later when it came to the matter of establishing posts and permanent settlements, we find that entrance was made by each of these three river systems. Aside from the soldiery the first white settlers came by way of the Red river,² but by 1850 the larger number of

1. Folwell: Minnesota. pp. 7-21.

2. Ibid: pp. 78, 79.

settlers had come in by way of the Mississippi. It was not until considerably after that date that the Lake Superior route had contributed more immigrants than that of the Red river. Had there been no major drainage lines connecting the state with the more densely populated regions to the east and south there is little doubt but that its development would have been somewhat delayed.

The impelling causes that brought the French so far west so early were several. The principal ones were the desire to do missionary work among the Indians, to find a water route to the Pacific, the innate love of adventure, the desire to achieve fame through some great discovery, and to trade with the Indians, getting from them the furs at that time much in demand in the European markets. It was for furs that Radisson and Grosseilliers first came into this region and on their return from their second trip they are said to have reached Montreal in 1660 "in sixty canoes loaded with furs worth \$40,000." Probably only a small portion of these were obtained within the confines of Minnesota. Duluth was sent out by a company of Canadian merchants who desired to establish trade about and beyond the head of Lake Superior, and from that time until approximately 1850 furs were the leading product of what is now Minnesota. It should be added that the fur industry was the leading industry of Minnesota for a much longer time than any other single industry.

In considering the importance of the part played by the furs in bringing the French and later the English into this region, it should be remembered that after all the presence of the animals bearing the high quality of furs found here is a reaction to the climatic conditions that obtain. With an abundance of lakes, with large forest and large prairie tracts, and with long, cold winters this region furnished an ideal habitat for fur bearing animals. Thus did the climate of this mid-continent area play a part in bringing about its early exploration.

In still other ways the climate has played an important part in the development of this state, in some respects the influence being direct and of an unfavorable character. For several months of the year the streams are un-navigable because of the ice. In the early days of St. Paul navigation on the Mississippi was "not to be relied on after the first week in November; and steamboats arrived in the spring about the 10th or 12th of April."³ Thus before the coming of the telegraph and railroad there were five months when the village had little communication with the outside world. The following taken from the *Minnesota Pioneer* of April 28, 1849, is typical of those times: "During five months the communication between this part of the country and our brethren in the United States has been difficult and unfrequent. A mail now and then from Prairie du Chien, brought upon the ice in a 'train' drawn sometimes by dogs, containing news so old that the good people in the country

3. Sibley: *Description of Minnesota*. Minn. Hist. Soc. Coll. Vol. 1, pp. 40, 41.

below had forgotten all about it.—When the milder weather commenced, and the ice became unsafe, we were completely shut out from all communication for several weeks." To the extent that these conditions were known to the people to the states to the south and east they acted as a deterrent to prospective immigrants. Besides little in the way of building operations was done here during the winter months.

Preceding 1850 the impression was abroad in some sections of the country that the frost free season here was too short for the maturing of most agricultural crops. In the early issues of the *Minnesota Pioneer* statements to correct this idea occur frequently. But it was not long until it was abundantly proven that crops would mature here as surely as farther south.

The falls and rapids of the streams have played an important part in the development of the state since they determined the places of portages, in some instances the head of navigation, and later, because of the water power, the location of urban centers. But two examples need be mentioned. A short distance below the falls of the St. Croix the first settlement of Americans was made within the state in 1839, and soon there grew up settlements along this river which centered about Stillwater and which in 1849 were outnumbered only by those about St. Paul. The Falls of St. Anthony determined the sites of both St. Paul and Minneapolis, the former at the point to which boats could conveniently ascend, and the latter at the power site itself. It has recently been shown that within another mile of recession⁴ the Falls of St. Anthony would have disappeared, and had this been accomplished before the white man appeared upon the scene it is quite likely that the metropolis of the state would not be where it now is. That the early settlers appreciated the value of the power sites is shown by the fact that within the shortest possible time after the tidings of the ratification of the Indian treaty ceding the triangular strip of land between the Mississippi and the St. Croix to the Government claims abutting the Falls of St. Anthony on the east bank and those of the St. Croix were staked out.⁵

The original forests of Minnesota influenced its early development both unfavorably and favorably, but the latter influence has been by far the greater. The principal unfavorable influence was the difficulty offered to the laying out of the early trails and roads. Usually the trails kept to the prairie stretches as much as possible for the traders had not the time nor were they disposed to expend the means necessary to construct roads through a wooded country. This often resulted in the sacrifice of directness of route. Of the three routes from St. Paul to the Pembina settlement, two, the southern and the middle, clung to the open prairie practically all the way.⁶

By far the largest influence of the forests has been in the lumber they have yielded. The first lumber mill in Minnesota was erected at the Falls

4. Soper: The burlied rock surface and preglacial river valleys of Minneapolis and vicinity. *Jour. Geol.* Vol. 23, p. 446.

5. Folwell: *Minnesota.* pp. 80-81.

of St. Anthony in 1821 for the purpose of sawing lumber for Fort Snelling. The lumber industry did not begin until 1838 for previous to that time private ownership of land within the state could not be acquired. By 1850 the lumber industry rivalled the fur trade in importance and very soon surpassed it.⁷

When it came to occupying the land the settlers preferred the prairie tracts, for by the time settlement began here it was known that absence of timber did not necessarily mean poor soil. At first, however, the settlers kept close to the timber so that the fuel needed for the rigorous winter could be secured easily. The fertile soils of the state did not begin to assume primary importance in its development until toward the close of the 1850's. By 1860 agriculture had forged to the front among the state's industries where it has since remained. In the decade 1850-1860, when the agricultural lands were being rapidly occupied, Minnesota had her greatest percentage increase of population, 2,730%, a percentage increase unequaled by any of the states in any decade.

It is an interesting fact that one of the natural resources Minnesota was early believed to possess should actually be the last one to assume great importance. During the French period rich metal deposits were believed to exist in this region, but in what section they were to be found was not so clear. So strong was this belief that Le Sueur came into the country in 1700 in search of copper. He ascended the Minnesota to the Blue Earth, and a few miles above its mouth discovered a deposit which he supposed to be copper. He loaded his canoes with this "blue earth" and about 4,000 pounds of the clay eventually found its way to France by way of New Orleans.⁸ It was not until 1884 that the production of metals began in Minnesota. And it is to this industry that the "Range towns" and Duluth owe their recent rapid growth.

6. Pope: Exploration of the T'y of Minn. Ex. Doc. 42, 31st Cong. 1st Sess. pp. 8, 9, 16, 19.

7. Robinson: Economic History of Agriculture in Minnesota. Univ. of Minn. Studies in Social Sciences, No. 3, p. 39.

8. Neill: Minn. Hist. Soc. Coll. Vol. 1, pp. 33-34.

MINNESOTA

ESTIMATED AMOUNT OF TIMBER STANDING IN THE STATE IN 1911

Species	M. B. F.	Species	M. B. F.
Ash	144,442	Oak	96,645
Balm of Gilead.....	1,189,000	Jack pine	3,141,850
Basswood	495,380	Norway	4,625,750
Balsam	370,300	White pine	3,818,000
Birch	152,983	Poplar	4,044,000
Cedar	634,000	Spruce	2,292,800
Elm	92,611	Tamarack	1,685,450
Maple	163,977		

M. B. F. signifies 1000's of board feet.

MANUFACTURES IN MINNESOTA

By E. Dana Durand

University of Minnesota

MINNESOTA is still primarily an agricultural state. It is true that at the last decennial census the value of manufactured products in the state, \$409,420,000,* greatly exceeded the net value of agricultural products. Assuming that approximately one-half of the value of animal products is represented by the value of crop products fed to animals, the total value of Minnesota's agricultural output in 1909 was about \$240,000,000. But the true measure of the importance of manufacturing industry is the value which the manufacturing process adds to raw materials, the materials being chiefly the products of agriculture or of mining. The value added to materials by Minnesota factories in 1909 was about \$128,000,000, somewhat more than half the net value of agricultural products. In the United States as a whole the value created by manufacturing industry exceeds by about one-fourth the value of agricultural products.

CHARACTER OF MINNESOTA'S MANUFACTURES

A striking feature of manufacturing in Minnesota is the predominance of industries which add comparatively little to the value of raw materials. Of the gross value of manufactured products in Minnesota at the last census only 31 per cent represented the part created by manufacturing processes, while the corresponding proportion for the United States as a whole was 41 per cent. The great importance of the flour mills, the meat packing establishments, and the creameries of Minnesota largely accounts for the fact that the value of raw materials used by her manufacturing establishments is more than double the value which they add to those materials.

THE STATE'S RANK

Of the gross value of manufactures for the United States as a whole Minnesota produces one-fiftieth, a slightly smaller proportion than that which her population forms of the total population. Of the value added to materials by manufacturing processes, however, Minnesota contributes only 1.5 per cent, and of the number of wage earners in manufacturing industries she has only 1.3 per cent. Among the states Minnesota in 1909 ranked thirteenth in gross value of manufactures, thirteenth also in value added to materials by manufacturing processes, but only eighteenth in number of wage earners engaged in manufacturing industries. On the other hand, she ranked eleventh among the states in value of crops, with 31½ per cent of the total value for the United States.

As in the United States as a whole, manufacturing industry in Minnesota is increasing more rapidly than agricultural industry. This fact does not

*The results of the quinquennial Census of manufactures, taken in 1915, are not yet published.

appear from the statistics for value of output, because the unit prices of agricultural products have gone up so much more rapidly than those of manufactured products that the total value of the output of the former has, in the United States as a whole and likewise in Minnesota, increased at substantially the same rate as that of manufactured products. The number of persons engaged in manufacturing industry has, however, risen much faster than the number in agriculture, and if there were some way of totalling the physical quantities of output of diverse products, the increase in manufacturing industries would, beyond question, appear much the greater.

However, manufacturing industry in Minnesota is not growing more rapidly than in the United States as a whole. The gross value of the products of Minnesota factories increased 83 per cent between 1899 and 1909 and the value attributable to manufacturing processes 74 per cent. These percentages were substantially the same as those for the country as a whole. On the other hand, the number of wage earners in manufacturing plants in Minnesota increased 31 per cent, while the corresponding figure for the entire country was 40 per cent. More than half of the states showed greater percentages of increase in value of manufactures during the decade than Minnesota.

Nevertheless Minnesota ranks third among the states west of the Mississippi in manufactures. Only Missouri and California are more important in this respect.

THE PRINCIPAL MANUFACTURES

The following table lists the leading industries of Minnesota in 1909 according to three different standards of measurement—the gross value of products, the value added by manufacture and the number of wage earners. There is very considerable difference in the ranking of industries in Minnesota according to these different standards. From most standpoints the ranking according to value added by manufacture or according to number of wage earners is more significant than that according to total value of products.

Rank of the leading industries of Minnesota, 1909

<i>As measured by value of product</i>	<i>As measured by value added by manufacture</i>	<i>As measured by number of wage earners</i>
Flour mills (34%)	Lumber mills (17%)	Lumber mills (24%)
Lumber mills (10%)	Flour mills (12%)	Railroad repair shops
Meat packing	Printing & publishing	(10%)
Butter and cheese	Foundries & machine shops	Foundries & machine shops
Printing & publishing	Breweries	Printing & publishing
Foundries & machine shops	Railroad repair shops	Flour mills
Railroad repair shops	Meat packing	Boot & shoe factories
Linseed oil mills	Bakeries	Men's clothing
Breweries	Patent medicines, etc.	Meat packing
Boot & shoe factories	Boot & shoe factories	Marble & stone work

Flour Milling.—As might be expected from her own great grain fields and her proximity to still greater grain fields further west, by far the most important industry in Minnesota as measured by value of products is that of flour milling. This alone accounts for more than one-third of the total value of output of her factories. Minnesota far outranks any other state in the flour milling industry. In 1909 she turned out nearly one-sixth of the total value of products of this industry in the United States. However, the great bulk of the value of flour and other products of the grain mills is represented by the grain itself, the value added by manufacturing processes constituting only about one-ninth of the total. Consequently the flour milling industry ranks below the lumber industry in value added by manufacturing processes, and ranks only fifth among the industries of the state in number of wage earners—this latter fact attesting strikingly to the highly automatic character of the machinery used in the great Minneapolis mills. Minnesota, however, is justly proud of the great flour mills which cluster around the falls of St. Anthony. Their product is famed for its quality throughout the country and the world. No other flour mills anywhere equal in size or in efficiency these great establishments.

The lumber industry still outranks all other manufacturing industries in Minnesota in the number of wage earners employed. This industry, as treated by the census, includes the cutting of timber as well as its manufacture into lumber and other products. As might be expected, however, from the rapid exhaustion of Minnesota's native forests of white pine and other woods, this industry is declining in absolute importance and still more in relative importance.

The meat packing and butter and cheese industries are naturally important in this great agricultural state.

In the manufacture of *linseed oil* Minnesota occupies a very important place, as a large proportion of the country's output of flax seed, which constitutes the raw material, is produced in Minnesota and the Dakotas. Nearly one-third of the linseed oil manufacture of the country is conducted in this state, although New York, curiously enough, ranks even higher.

The other leading manufacturing industries of Minnesota, unlike the five just mentioned, are neither dependent upon her agricultural products nor her forests. In fact, their importance cannot be attributed to any special natural resources within the state. They are such miscellaneous industries as naturally grow up in large cities.

IRON MANUFACTURES, PRESENT AND FUTURE

It is a striking fact that up till 1915 no important manufacturing industry developed in Minnesota as the result of the presence in the state of the most magnificent iron mines of the world. Minnesota produces five-eighths of the output of iron ore in the United States, but down to the present time practically none of that ore has been smelted or otherwise used in the state. It

has been shipped to Lake Erie or lower Lake Michigan ports for manufacture in their vicinity. Fortunately an immense iron and steel plant has just been built at Duluth and even now is commencing operations. The prospects are that the manufacture of the heavy forms of iron and steel will soon become one of the leading industries of the state and that the greater part of the demand for these products throughout the Northwest will be supplied from Minnesota plants. While the state is lacking in the coal necessary for the smelting and manufacture of iron and steel, it is obviously advantageous for ore vessels returning from the lower lakes to load with coal for Lake Superior ports. However, the lack of coal within the state of Minnesota does considerably hamper the development of manufacturing industries.

MANUFACTURING CITIES

A large proportion of the manufacturing industry of Minnesota is confined to the three great cities, Minneapolis, St. Paul and Duluth. There are comparatively few states in which such a large proportion of the urban population is found in such a small number of individual cities. Winona, the next city to these three in size, has less than one-fourth of the population of Duluth and less than one-fifteenth that of Minneapolis. There are only four other cities exceeding 10,000 in population. The following table compares the principal data (in round numbers) regarding manufacturing industries for the three leading cities with those for the state as a whole.

Manufactures in Minnesota, 1909

	Wage earners		Value of Products		Value added by manufacture	
	Number	Per cent of total	Amount	Per cent of total	Amount	Per cent of total
<i>Minnesota, total</i>	84,800	100	\$409,000,000	100	\$128,000,000	100
Minneapolis	27,000	32	165,000,000	40	45,000,000	36
St. Paul	19,300	23	59,000,000	14	29,000,000	22
Duluth	6,100	7	17,200,000	4	8,300,000	7
All other places...	32,400	38	168,000,000	41	45,000,000	36

This table shows that fully three-fifths of the manufacturing is carried on in the three leading cities. Minneapolis, the largest city, ranks first in respect to all three of the standards of comparison shown in the table, but its lead with respect to number of wage earners and value added by manufacture is far less marked than that with respect to total value of products, a fact attributable to the predominance of the flour milling industry in Minneapolis and the relatively small number of wage earners and relatively low value added by manufacture in that industry. It will be observed that, whereas for Minneapolis the value added by manufacture forms only a little more than one-fourth of the total value of products, for St. Paul and Duluth the

proportion is nearly one-half. It may be noted that the figures for St. Paul do not include the large meat packing plant in South St. Paul.

The value of the manufactured products of the other cities of more than 10,000 inhabitants in Minnesota in 1909 was as follows:

Winona, \$11,200,000
Mankato, \$3,700,000
Stillwater, \$2,700,000
St. Cloud, \$2,300,000
Virginia, \$500,000

MINNEAPOLIS AND ST. PAUL

There is very considerable difference between Minneapolis and St. Paul with respect to the rank of manufacturing industries. As measured by total value of products the leading industries in Minneapolis are in order: Flour mills, lumber mills, foundries and machine shops, printing and publishing, railroad repair shops, bakeries, and breweries. In St. Paul they are: Printing and publishing, foundries and machine shops, breweries, boot and shoe factories, railroad shops, fur goods factories, and butter and cheese factories. Not far from one-half of the total value of manufactured products in Minneapolis is represented by the output of the flour mills, but there is no such one predominating industry in St. Paul. Even in respect to value added by manufacture the flour milling industry ranks first in Minneapolis though with no very great lead over the lumber and printing industries. In respect to number of wage earners, however, the flour mills of Minneapolis rank below her lumber mills, foundries and railroad shops.

The manufacturing industries of St. Paul have of late been growing somewhat more rapidly than those of Minneapolis. This is in considerable measure attributable to the convenience for shipping afforded to manufacturing establishments by the Minnesota Transfer Railroad in the so called Midway district, which lies between the hearts of the two cities, but with the greater part of its area in St. Paul. An active movement is on foot for the creation within the city limits of Minneapolis of an industrial district offering similar facilities. There is a healthy rivalry between the two cities in efforts to build up their manufacturing interests.

As might be expected from the fact that it is a smaller and more rapidly growing city, the manufacturing industries of Duluth increased during the last census decade at a higher rate than those of St. Paul. The opening of the new steel plant at Duluth will probably cause its aggregate manufacturing business to increase still more rapidly during the present decade. The lumber industry has heretofore represented nearly one-third of the manufacturing of Duluth.

MINNESOTA CITIES: MINNEAPOLIS

By C. E. Huff

West High School, Minneapolis

HISTORY

MINNEAPOLIS, "City of the Falls,"* is the metropolis of the state and the gateway to the northwest.

Like many another city in this great new country of potential wealth, its history reads like a fairy tale. Less than seventy years ago the land where Minneapolis now stands was a broad stretch of level prairie interspersed with gently rolling hills and forest stretches, and inhabited by Indians. To be sure a saw mill was built on the present site of the Pillsbury-Washburn flour mill "A" as early as 1821, and a flour mill followed soon afterwards. But it was not until 1838 that the government gave permission to stake out claims for settlement. The first of these claims to be staked were adjacent to the falls and included all possible power sites, for even at that time the adventurous newcomers saw wonderful possibilities in the water power of the falls. From the first settlement to the present time the development of the city has been almost phenomenal, with an average increase in population of over five thousand people for every single year in its history. So it now has a population of about 350,000.

The reasons for this rapid growth are found largely in the geography of the region together with the fact that it is the commercial gateway to an agricultural empire larger than England, Germany, and France combined. The story of its development is the story of logging camps and lumber woods to the north, of log drives on rivers and of saw mills at the falls. It is the story too of wheat fields and of railroads and flour mills. And in her effort to provide materials for shelter for the ever increasing population of the expanding northwest, and to furnish bread for the millions in many parts of the earth, Minneapolis with St. Paul has become the great industrial and commercial center of the upper Mississippi.

GEOGRAPHICAL SETTING

The physical environment of Minneapolis has favored this development. From the heart of the big forests of white pine and other lumber producing trees, which formerly covered most of the northern part of the state, there flowed the Mississippi with many smaller tributaries. With the melting snows each spring these streams have borne hundreds of millions of feet of logs from the pineries to the mills at only a nominal cost to the lumberman. With the coming of railroads the wheat fields were brought to the very door of Minneapolis, for stretching away to the west are the nearly level prairies

*For a brief history of Minneapolis see Parsons, "The Story of Minneapolis." (Board of Education.)

which not only produce bounteous crops, but furnish easy grades for railroads which may be built at a minimum cost.

The Mississippi and other smaller rivers have been important in other ways in effecting the development of the city. Within the memory of many citizens still living in Minneapolis small steamboats carried freight and passengers not only up to St. Anthony Falls but to various points up river above the falls. In the same way the Minnesota and St. Croix were also of much value during the early period of development. Now that the railroads have come to carry the rapidly increasing volume of commodities, they find their easiest grades, even in this prairie country, along the valleys of the Mississippi and Minnesota rivers.

Not only have the falls, the forests, the fertile soils, the rivers and their valleys, and the level prairies encouraged the development of a city here, but as if to force us to the task, nature has laid down here untold quantities of the very best building materials. Blue limestone is all about, beneath only a few feet of glacial drift. In both the business and residence parts of the city are great quantities of water washed sands and gravels which are so valuable in modern building operations where Portland cement is used.

Another geographic factor has favored the development of the city. It is at the crossroads of the continent. With Duluth, Winnipeg and other cities to the north, and New Orleans and many other southern cities near the Gulf of Mexico, and in an almost direct line with our Atlantic and Pacific ports by way of the level Mohawk valley and shore of the Great Lakes, and westward over the Rockies by way of the lowest mountain passes, Minneapolis is at a point of vantage seldom surpassed by an inland city.

THE WATER POWER

How important the Falls of St. Anthony and the rapids in the river have been to the city can be best appreciated when it is known that there are three dams across the Mississippi within the environs of the city, and that they have a total average horsepower of from 55,000 to 60,000. All of this power is in constant use in running the flour mills or to provide electric current to be used by the street railway. Another thirty foot dam across the Mississippi near Minnehaha Falls will soon be completed, but what use will be made of the 15,000 or 16,000 horse power from this dam has not yet been decided. Still another source of power is the St. Croix River at Taylor's Falls, fifty or sixty miles away. This has an ultimate capacity of 40,000 or more horsepower. At present the General Electric Company brings to Minneapolis from this source 20,000 or 25,000 horse power to be used for lighting and other purposes.

INDUSTRIAL DEVELOPMENT

With all these advantages, Minneapolis would have been slow to develop had it not been fortunate in having its development furthered by the indivi-

dual and organized effort of progressive men. And as men have responded to these natural conditions industry, commerce, education and beauty have come into being.

Flour. Of the manufactures, flour and other cereal products stand out preeminently; for, as is well known, Minneapolis is the largest flour manufacturing center in the world. The annual grain receipts are nearly 200,000,000 bushels. During the months of September, October, November, and December, 1915, more than a thousand carloads of grain were received daily, and of the total during these four months, nearly eighty thousand carloads were wheat. This vast quantity of grain is stored in fifty terminal elevators with a storage capacity of 38,550,000 bushels.

But this wheat has not long to lie in elevators, for at the rate of nearly 80,000 barrels a day the twenty-three mills grind it into flour, the annual output being about 18,000,000 barrels, having a value of about \$70,000,000. This flour finds a ready market in all countries of the earth where men eat white bread. However, with the ever increasing demand in this country, only a little over a million barrels a year are exported.

Linseed Oil. Next to flour comes linseed oil, of which Minneapolis is the largest manufacturing center in the world. Flaxseed in large quantities is received from the grain fields of the northwest. During the year 1913 fourteen and a half million dollars worth of oil and six and one half million dollars worth of oil cake were manufactured. While the oil finds a ready domestic market, 75 per cent of the oil cake was exported.

Lumber. For many years Minneapolis has been considered the lumber center of the northwest. With the clearing away of the northern forests it is losing its importance as a lumber manufacturing center, though it still has an annual output of something like 200,000,000 board feet, and the output of lumber and lumber products have a value of \$12,000,000. While the manufacture has decreased in recent years Minneapolis firms still own and finance thirteen hundred retail yards through which they distribute 1,500,000,000 feet of lumber. It not only leads all cities in the distribution of lumber but with its twenty-eight factories, leads in the manufacture of sash, doors, etc.

Farm Machinery. With abundant labor, capital and power at hand, and with thousands of farmers on the vast plains calling loudly for more and better machines, Minneapolis has recently become the leading city in the distribution of farm implements. Not only is it a distributing center, but also occupies an important place in the manufacture of gas tractors, threshers, plows, etc., as well as many other kinds of machinery on a smaller scale.

Other Manufactures.—Printing also occupies a place of some importance with over two hundred establishments, and a product valued at six and one half million dollars.

To these may be added such products as bread and bakery goods made in one hundred establishments and having a value of over three million dollars; butter, cheese, packed meats, confectionery, ice cream, malt liquors, drugs, medicines, and tobacco, with a total value of almost ten million dollars. Clothing, building materials, furniture, jewelry, leather goods, paper goods, etc., swell the total factory output to over \$200,000,000.

TRANSPORTATION

With nine railroad systems, consisting of twenty-six lines, entering the city, Minneapolis has facilities not only for collecting farm products, but is well equipped as a distributing center. The shipping facilities are made doubly effective by the fact that railroad lines extending eastward parallel the Great Lakes thus making the rates low. Added to this is the fact that within another year, with the completion of the thirty foot dam across the Mississippi near Minnehaha Falls, Minneapolis will become the head of navigation. Terminal facilities for handling river freight are nearing completion. A six foot channel is promised. Through the one thousand jobbing houses an annual wholesale business of \$300,000,000 is transacted.

PUBLIC IMPROVEMENTS

The physical features within and around the city are such as invite improvement for the welfare and pleasure of the people. Within a radius of twenty-five miles there are two hundred lakes, including Harriet, Calhoun, and the far famed Minnetonka. With a total area of fifty-three square miles, Minneapolis has eighty-five parks containing about four thousand acres, one third of which is water. There are thirty-seven miles of park drives and boulevards connecting the public parks, including Minnehaha Falls. There are twenty-two miles of Mississippi River frontage, with eighteen bridges crossing the river. The city water plant consists of two reservoirs and five hundred twenty-one miles of watermains. There are two hundred miles of paved streets and three hundred fifty miles of sewers. The street railway has one hundred eighty-eight miles of track and operates five hundred twenty-five cars.

As an educational, music and art center, Minneapolis ranks high. In addition to 50,000 children attending seventy grade schools and six high schools, ten thousand children attend other schools within the city. It is also the seat of the State University with an enrollment of seven thousand three hundred.

Thus Minneapolis, "City of the Falls," in the midst of raw materials and with accessible markets and enterprising business men has become a city of beautiful homes built up with her ever growing industries and expanding commerce.

MINNESOTA CITIES: ST. PAUL

By L. L. Everly
St. Paul Normal School

SEATED on her seven hills, this capital city occupies a position that is both picturesque and full of historic interest. At the southwest corner of the city the bayou-strewn valley of the Minnesota joins the similar valley of the Mississippi which continues northwestward into the heart of the city and then turns abruptly southward. The steep right bank rises from one to two hundred feet above the river, while the left bank, rising half as high, takes the form of a stone terrace a half-mile or more in width and furnishes a commodious area for the business portion of the city. Back of this, morainic hills tower another hundred feet and offer a picturesque location for the residences and numerous parks. Thus, one may ascend from the alluvial flats at the river brink with their public baths, steamboat docks, railroad yards, and Union Station to the stone terrace with its great wholesale warehouses and business blocks, and then on up to the higher level with its residences, stately churches and imposing State Capitol.

First discovered by Father Hennepin in 1680, visited by Jonathan Carver, a Boston trader, in 1766, officially described by Lieut. Zebulon Pike in 1805, St. Paul began as a settlement and trading post in 1838. Down the Minnesota and Mississippi came the birchbark canoes laden with furs, while up the great river came the trader and settler. Eleven years later the settlement had grown to a population of 840, had been surveyed and organized as a town, and honored by being made the capital of the new territory.

In 1847 a line of river packets began making regular trips between St. Louis and St. Paul. From the Red River valley and the great plains of the Dacotas thousands of buffalo skins were brought by caravans of "Red River Carts," often a hundred in a single caravan. These strong, wide, wooden carts brought their loads so frequently that it was not an uncommon sight to see acres of bales of buffalo skins awaiting shipment on the levees.

In 1871 local manufacturers began making these skins into overcoats and sleigh robes and soon developed a wholesale trade. The buffalo became extinct in 1884 but since that time St. Paul has maintained her preeminence as the leading manufacturing center of *high grade* furs in the United States. Sixteen firms are now working up over 2,000,000 skins each year, the total business exceeding \$7,000,000 annually.

From this head of river navigation railroads began developing in 1862 until now nine railway systems (23 lines), four being transcontinental lines, center here, representing a total mileage of over 57,500, about one-fourth of the total railway mileage of the United States. Seven railroad repair shops located here furnish an annual product valued at nearly \$4,000,000. Three hundred and thirty-nine passenger trains and an average of 29,000 passengers pass through the St. Paul Union Station every day. Passing this station are the tracks of an interurban electric railway operating over 400 miles of track.

while one block away are the docks of the river packet lines. River traffic is increasing with new types of all-steel barges and deepened channel.

The splendid railway service to the north and west has developed many industries. It brings shipments of a coarse grass from glacial swamps to yield its fiber for the manufacture of carpets, and also the product of the great wheat fields to supply the needs not only of a large modern flour mill but also those of one of the world's greatest bakeries turning out 100,000 loaves daily.

The shipments of the products of the grazing lands of the northwest have caused the growth of the live stock market and meat packing industry. From a small market supplying local needs it has grown to become a world's market, doing an annual business of over \$500,000,000. Each day long strings of cars discharge hundreds of cattle, sheep and hogs, sufficient to make an unbroken line seven miles in length.

The leather from the hides of domestic animals is used in great quantities by the workmen of four shoe factories. From small beginnings they have developed until over 3,000,000 pairs are manufactured annually.

The butter from the \$100,000,000 worth of milk yielded by Minnesota dairy cattle comes in such quantities to St. Paul as to make it the second largest butter-producing market in the nation. Ten factories strive to produce a uniform quality and flavor of high merit. Minnesota's abundant grasses, copious supply of pure water and numerous converging railway lines serve to accomplish this result.

From the pine forests comes the material which three factories make into boxes. Machinery planes the boards, saws them to proper length and drives the nails, thus turning out daily over 10,000 boxes to meet the needs of the wholesale houses and other shippers.

Another industry, but one step removed from this, is the use of carloads of paper, a by-product of the forest, in the manufacture of boxes. Several firms are busy at this work, turning out millions of boxes, cartons, and containers of every description.

Likewise another product of the forest paper and the efficient mail service of the many lines of railway is the great development of the printing and book-binding industry. Over seventy firms are engaged in this industry, producing newspapers, magazines and books having an annual value of over \$50,000,000.

The buffalo overcoat of former years has disappeared but in its place the sheep-lined coat and woolen mackinaw serve quite as effectively. The growing wholesale trade in these has called for a trade in other forms of men's furnishings. Over 5000 pairs of overalls are manufactured daily, while 1,000,000 hats and a still larger number of shirts are supplied to the trade annually.

Likewise one of the largest millinery establishments in the world to-

gether with a half dozen other wholesale millinery houses are located here turning out over a million hats annually.

A wholesale trade in drugs, chemicals, dental supplies, candies, mushrooms, brushes, and other commodities has grown to supply the local trade and that of the great northwest.

These various industries have developed the city as a financial center. Fifteen banks in operation, annually receive deposits of more than one hundred millions of dollars. Business activity has resulted in clearing house receipts of more than two million dollars daily.

The greatest public building of the city is the State Capitol imposingly situated on a commanding eminence. It is a marble building of beautiful proportions, richly decorated with famous paintings and sculptures. It was erected at a cost of \$4,500,000. The Federal Building, United States Customs House, City Hall, and Court House, Wilder Charities Building and Public Baths, the fireproof Municipal Auditorium seating 10,000 people, and the new million dollar Public Library, are some of its chief public buildings. Beautiful churches and an imposing cathedral serve the people's higher interests.

Six colleges, four seminaries, four public high schools, a city normal school, fifty-seven public schools, an institute with its art school and evening classes in many departments, known as the Peoples University, together with twenty parochial schools, offer splendid educational advantages. The six colleges are the State Agricultural College, Hamline University, Macalaster College, St. Thomas College, Concordia College and the St. Paul College of Law.

The city's low typhoid death rate of 19.5 per 100,000 is due to pure city water obtained not from the river but from a series of spring-fed lakes extending twenty miles north of the city, to its hills with a sandy subsoil providing a perfect drainage, and to its bracing climate.

Nine public playgrounds maintained by the city, equipped with shelter houses, swimming pools, shower baths and out-of-door apparatus, invite to hours of pleasure.

With its picturesque river, with its numerous lakes within convenient trolley ride offering opportunities for motorboating, canoeing, fishing and camping, and with its seventy-nine parks and famous boulevards, St. Paul is indeed a city beautiful. The city's future is bright with promise.

MINNESOTA

NORMAL SCHOOLS

Minnesota supports five State Normal Schools: at Winona, Mankato, St. Cloud, Moorhead and Duluth. The aggregate attendance last year (1914) was 4,166. Tuition is free. The cost of board and room is from \$3 to \$3.50 a week. Dormitories are provided at all of the schools.

MINNESOTA CITIES: DULUTH AND THE RANGE TOWNS

By Eugene Van Cleef
State Normal School, Duluth

UNIQUE, is the word that best describes the group of cities in the northeastern corner of Minnesota. Nowhere on the surface of the earth can a situation similar to this one be cited. True, one may point to harbor cities and to couplets consisting of an inland town and its port on the sea. But where is there another Iron Range like that in Minnesota, beaded with cities of such remarkable growth and unusual contrasts? Where is there another harbor such as Duluth's, so spacious, so nearly ideal, yet whose business is so simple?

THE IRON RANGES

About 85 miles north of Duluth lies the MESABI RANGE and about 15 to 25 miles further north is the VERMILION RANGE. These ranges do not consist of a series of conspicuous heights of land, but rather constitute a rolling topography with occasional hills rising from 100 to 150 feet above the general level. The average height above sealevel is about 1500 feet and above Lake Superior about 900 feet. The Mesabi Range assumes an inverted S (S) form with the ends decidedly elongated. The general direction is east by northeast to west by southwest. At the western extremity the last town of size is *Hibbing*, while the eastern extremity is marked by *Biwabik*. Between these towns, going from west to east, one passes through *Chisholm*, *Buhl*, *Virginia* and *Eveleth*. Separating these towns are still smaller communities.

On the Vermilion Range, *Tower* marks approximately the western extremity and *Ely* the eastern end with no town of consequence between. This range, of more limited area than the Mesabi and of different structure, trends in a slightly northeast-southwest direction.

The entire northeastern portion of the state was covered with extensive white pine and giant Norway pine forests to within about 25 years ago. The pioneer with pack on his back penetrated the stillness of this wilderness. It was not long before he became aware of the presence of ore, although at first he did not realize the magnitude of the wealth which lay under his feet. Many a man turned back from the wild lands and the miseries of long cold winters; but a few continued exploring the region, eventually to be well repaid for the hardships endured. In 1884 small shipments of iron ore reached Two Harbors. In 1892 the output of the Vermilion Range equalled nearly one million tons, and that from the Mesabi only 29,000 tons. The quantities of ore shipped now from the Mesabi Range annually approximate 25,000,000 to 30,000,000 of tons.

THE RANGE TOWNS

of the Range Towns may be characterized as of the mushrooming dates from 1892 and today has a population estimated village of *Chisholm* only 7 miles east, was incorporated in

1901 with a population of but 250. In 1910 the U. S. Census reported 7684, and now the residents estimate the population close to 10,000. *Virginia* numbered only 2962 in 1900. The estimate for 1915 as given by the Federal Census Bureau is approximately 15,000. Such a growth occurred despite a devastating fire in 1903 which momentarily erased the town from the map.

The structure of these *villages*, as they are technically designated, is rather striking. In most instances the great open-pit mines form a circle about the village. The miners do not live in the center of the village, but rather in rows of frame houses of uniform architecture, which occupy the vacant areas between the mines. These *Locations* as they are termed, lie from a half mile to four miles from the business district. The *Locations* are moved by the mining companies as the mines encroach upon them. In fact whole towns of several thousand people have been unhesitatingly transported a distance of a half mile to a mile in order that mining operations might be extended. Occasionally a *Location* grows to such size and importance that it is incorporated within the village limits, thereby adding materially to the wealth of the community, for the larger the area of ore deposits within the village, the larger the amount of taxes that go into the village treasury. There may be as many as six to ten *Locations* about a village.

INDUSTRIES OTHER THAN MINING

In only one of these towns has the lumber industry exercised a decided influence. A large white pine lumber mill, said to be the largest of its kind in the country, has contributed a good share to the prosperity of *Virginia*. Lumber mills have been located at other points on the range, but for only relatively short periods of time. No other industries of significance have been established.

At present the inhabitants are giving much thought to agriculture. In fact one may well say that there exists an "agricultural boom." It is estimated by some that the iron resources will last a hundred years or more. But there are those who realize the importance of a permanent resource and hence seek to establish one. The timber of value has been cleared, and now the land awaits the further enterprise of man. Earnest attempts have been made to produce crops, and some have attained a little success. Hay and a few root crops grow well, but the climate is still a handicap to general agriculture, especially to that which involves the raising of foodstuffs for the people. With eventual acclimatization of crops, such fertile soils as cover this territory may be expected to yield in goodly quantities. Patience and honest exploitation must result in final success. These communities may then become independent of iron mining, instead of continuing their present parasitic life.

THE MIXED POPULATION

The population is decidedly mixed. A few figures to show the nationalities of the students in the schools of Hibbing for 1913-14 will serve to represent the entire Range, for the mixture everywhere includes about the same

types and in the same proportion. Among 2355 students only 439 were Americans, that is, those whose parents were born in America.* The Finns rank next with 409, the Swedes with 321, the Italians with 315, and the Austrians with 210. The remaining 661 were divided among 24 nationalities. Such a motley assemblage, carrying with it the opinions and prejudices of 29 different nations, presents a problem in city government not easy of solution. Education has been the first attempt at solving the question of amalgamation. With the tremendous resources and the excellent foresight of the mining companies, school equipment has been provided which is not equalled anywhere else in the country. The brief period since the founding of these towns has not given a sufficiently long experience in the education of this mixture to afford conclusive results.

The future of the Range towns depends upon the extent of the deposits of iron ore still unmined and the rate at which the nations will continue to consume the ore. However, no matter how long the supply may last, the region must be developed agriculturally, or these towns will sound their knell with the last carload of ore.

DULUTH

At the front door of the Iron Range, Duluth has risen. It lies at the western extremity of the world's largest inland fresh water lake and at the farthest point inland along the Great Lakes' highway. It therefor is in easy and cheap communication with eastern cities and European ports.

In addition to iron ore, grain and lumber play a significant role in the development of the hinterland. In more recent years the cut-over lands and the muskeg (swamp) lands have begun to yield produce in diminutive amounts. While it is very doubtful whether sufficient quantities will be raised for large shipment, locally it may prove an important resource.

The city has grown steadily from about 5000 in 1880 to 78,466 in 1910. It may have reached 85,000 in 1915. The continued rise has in no small degree been due to the facilities for shipping to the east. The area of the harbor now accessible to railroads (as wharfage) is 664 acres while the total available area is 4069 acres. The entire harbor space includes eleven square miles, or 7040 acres. Neither Liverpool, Rotterdam nor Hamburg approach this area. Furthermore the linear quayage is roundly 49 miles, second only to that of New York City. The harbor is well protected from storm waves, tides, or strong currents; it is deep and has a soft bottom making anchorage easy. Boats 600 feet long and drawing from 20 to 26 feet of water maneuver easily without the aid of tugs.

Such facilities invite *commerce*. The tonnage for the eight months' season of navigation is next to that of New York City. The value is not so great for the commodities are raw materials of large bulk. Duluth distributes not alone to the east but also to the west. In exchange for lumber, ore, and grain, it receives tremendous supplies of coal, some hardware and grocer-

*The authority for these data states that a few may possibly have mothers of foreign birth.

ies. Clothing comes very largely by rail. These products are distributed throughout the northwest where they are in demand.

Manufacturing is limited to clothing, lumber, logging machinery, a little flour, bread, matches, and such other items as may find a ready sale in the northwest or locally. A plant for the manufacture of steel has been in the process of construction for many years. It is proposed to begin operations this year. Probably the distance from the eastern markets, high cost of labor locally, cost of transporting coal and limestone both of which must be brought from a distance, have been factors in delaying the beginning of this industry.

As long as iron ore and grain are available Duluth will continue to thrive. Lumber is less a factor now than years ago, for the forests are fast disappearing and each year sees the shutting down of some mill in the vicinity. The permanence of the city, as in the case of the Range Towns, lies not in the iron resources, but in the development of the agricultural resources. A certain food supply at low cost must be made available. When the latter is assured, the city will be a welcome haven to the masses, and industries of many varieties may develop without limit.

MINNESOTA

THE LESSER CITIES OF MINNESOTA

By R. J. Scarborough
State Normal School, Winona

WINONA, "The Gate City," ranks fourth among Minnesota cities, having a population of 22,000. It is situated in the Mississippi valley 103 miles below Saint Paul, 50 miles above the south-east corner of Minnesota, and 310 miles from Chicago.

The physical features of the vicinity include the river flood plain with its terraces, bordered by high bluffs. The river flows nearly eastward here, is about one-half mile wide, and the distance across the valley is three miles. The bluffs rise about 450 feet above the valley. Lying between the city and the southern bluffs, Lake Winona occupies a basin made by a former channel of the river. The city occupies the higher ground between the lake and the river, an area about one mile wide and four miles long. The streets, platted parallel to the river, and at right angles, extend about 20 degrees east of northward. In the extreme east the streets extend more nearly westward and northward. Valleys which have incised the upland make natural grades in which roads have been constructed leading to the city.

Transportation is made convenient for Winona by the roads of five railway companies and by transportation on the river. This last named means may increase greatly in importance within the next half-century, linking the name of Winona with those of Dubuque, St. Louis, Memphis, and New Orleans.

Three steel bridges span the Mississippi at Winona, there being two railway draw-bridges and a high wagon-bridge. Improved roads reach for ten

miles east, south, and west. Trolley cars are in service through nearly the entire length and width of the city.

Winona is an important manufacturing center, though the saw-mill days are gone. It is noted for proprietary medicines, stock-foods, flour, confections, wagons, linofelt, etc., sold over the United States and Canada. One medical company, having an imposing half-million dollar plant in Winona, in which nearly 400 people are employed, has 2700 salesmen working in 48 states and six provinces. The North Western Railway Company's shops employ 275 men. Cheap electric power is brought from Hatfield, Wisconsin, 60 miles east on the Black River, and a new plan proposes to generate additional power at Chippewa Falls, 100 miles northeast.

Parks are seen on the river-front, in the midst of the city, on the Lakeshore, and on the bluffside at the southwest. A fine new high school building is nearing completion. The Winona State Normal School, Minnesota's oldest and best equipped Normal, is justly proud of a new and complete Model School building, a Library building, a Dormitory occupying an additional city square, and a Model Rural School located four miles southwest of the city. The College of St. Teresa, for young women, and St. Mary's College, for young men, rank with the colleges of the northwest. Winona has two daily newspapers.

Red Wing (12,200) of Goodhue, is picturesquely situated on the bluffs overlooking the Mississippi, which is here spanned by a high bridge. Fourteen hundred people are employed in thirty manufacturing establishments. Furniture, linseed oil, sewer-pipe, and stoneware are among the principal products. Located at Red Wing are the Lutheran Ladies Seminary, the Red Wing Seminary for young men, and the State Training School.

Stillwater (11,000) overlooking Lake St. Croix, lies twenty miles northeast of St. Paul with which it is connected by trolley. Abundant water power has developed considerable manufacturing. The new State Penitentiary is located at Oak Park, a suburb of Stillwater, and in that institution a great amount of binding twine and machinery are manufactured.

Mankato (12,000) at the southernmost turn of the Minnesota River, is the metropolis of south central Minnesota. Four railway companies and the "Dan Patch" interurban serve the city. Street cars are also in service. Mankato is noted for its stone, lime, and cement, having a cement works with an annual capacity of 225,000 barrels. About fifty distinct industries are represented. A power plant on the Blue Earth River supplies cheap and abundant power. Two daily papers are published. Minnesota's second oldest State Normal School, and the Lutheran Ladies Seminary are located here.

Rochester (9,000) is noted nationally as the city of a good hospital and Drs. Mayo and Mayo. Usually about 1,000 persons are present in the city for treatment at St. Mary's Hospital. One of Minnesota's hospitals for the insane is here. The naturally pleasing site on the Zumbro River has been improved by a fine park system and extensive paving. The Franciscan Sisters'

Academy is located here. A large flour mill and a camera factory are two of the principal manufactories. Two daily papers are issued.

Faribault (10,000) is located at the confluence of the Straight and Cannon rivers. The business center stands on ground between the streams, while stately institutions and schools occupy the hills to the eastward. Topography and culture have given Faribault locally the name "The Athens of the Northwest." Here are located Shattuck Military School, Seabury Divinity School, Bethlehem Academy, and the State Schools for the Deaf, Blind, and Feeble Minded. Forty-three manufacturing establishments in Faribault are enumerated by the U. S. Census of 1910.

Albert Lea (8,000) of Freeborn, the "railroad spider" on the map of southeastern Minnesota, is built on high ground between two lakes. It is a jobbing and manufacturing point, and, excepting Duluth, has the only coal elevator and screenery plant in Minnesota. In the county, dairying has superseded wheat, and the city has a State Demonstration Creamery.

St. Cloud (11,000) "the Granite City," is the county seat and commercial center of Stearns, noted for granite quarries and fine stock. Three hydro-electric plants on the Mississippi furnish abundant power. Electric cars run throughout the city and on suburban lines north and west. The industrial establishments include two large flour mills, iron foundries, machine shops, and a woolen mill. Eight hundred men of the Great Northern shops, and of the train service, have their homes in St. Cloud. Two daily papers are published. Overlooking the river stands the St. Cloud State Normal school which has the largest enrollment of the state's five normals. St. John's University (Theological) and St. Benedict's Academy for girls are located near.

Little Falls (9,000) is a center for the manufacture of lumber, flour, paper, and creamery products.

Brainerd (10,000) the "Hub City," is located exactly at the geographical center of Minnesota, and has railway connections in the four directions. The Northern Pacific repair shops, located here, employ over 1,200 men. The Cuyuna iron deposits extend within the city limits.

Crookston (9,300) located at the edge of the Red River Valley has railway lines in eight directions. Electric power is developed from Red Lake River, and typical industries are flour mills, a saw mill, and a brick yard.

Fergus Falls (7,500) built on both sides of the Red River of the North has some of the finest hydro-electric developments in the northwest. Five dams furnish power to four flour mills, to the municipal electric-light plant and water works, and to nine other factories. Fergus Falls has the largest milling capacity between the Twin Cities and the Pacific coast. The State Hospital for the Insane has 1,400 patients and 300 employees.

Moorhead (5,500) is on the Red River opposite Fargo. Moorhead has railway lines in eight directions, also an efficient electric railway service throughout the city and to Fargo. The city's manufactories include a flour

mill, two wagon factories, a plow factory, and a planing mill, while just east of the city the Northern Pacific shops are located. Minnesota's fourth Normal School is located here. Concordia College stands in the south part of the city.

International Falls (4,500) of Koochiching, stands at the national boundary, separated from Ft. Francis, Ontario, by the Rainy River. Using electric power from the Rainy River, a pulp and paper mill, a saw mill, and a planing mill, are among the leading industries. An electric interurban connects with Ranier, five miles east. A daily paper is published.

Cloquet (8,000) located on the St. Louis River 25 miles from Duluth has five large saw mills and a fine paper mill. The manufacturing plants employ 2500 men. Logs often jam the river for miles. The city has a picturesque setting in the deep valley and on the hill sides.

MINNESOTA

THE STATUS OF GEOGRAPHY IN THE PUBLIC SCHOOLS

By P. C. Tonning

State Department of Education, St. Paul

IN THE ELEMENTARY SCHOOLS

GEOGRAPHY is more generally studied in the public schools than any other subject except possibly English and arithmetic. As a formal subject it is usually introduced in the third or fourth grades. The first work consists in the study of home geography, the village or the community, and the county, including the study of occupations, products, and industries, surface features from field excursions, streams, lakes, waterways, and so forth.

Sometimes the work is based on some such book as Robinson Crusoe; the struggle of man with the elements, and the manner in which he makes use of the natural resources at hand being the prominent geographical features of such study.

An elementary text book is introduced, as a rule, in the fourth or in the fifth grade. The work is frequently supplemented by the use of geographic or industrial readers. The advanced textbook is usually taken up in the sixth grade and completed in the seventh, leaving the eighth grade without work in geography. In some schools textbooks are practically dispensed with, supplementary geographic readers, periodicals, and reference books taking the place of the text.

IN THE HIGH SCHOOL

In the high school the subject is taken up in the form of physical geography, commercial geography, and what is known in Minnesota as senior geography, which is simply a review and amplification of a part of the grammar school geography. Each one of these subjects is studied for one semester and carries one-half credit towards graduation. The reports of the high and graded school inspectors show that last year physiography was studied in one

hundred and fifty-six high and graded schools; commercial geography in eighty-four; and senior geography in forty-two. It must be said, then, that on the whole, geography is a popular branch of study in the public schools. But the development and general results have not been commensurate with the importance of the subject—the only true sociological subject in the curriculum.

PRINCIPAL DEFECTS IN GEOGRAPHY TEACHING

One of the greatest defects in the work in geography is the purely statistical and cyclopedic character of the instruction in the upper grades. A teacher may start out with the correct basic notions and principles of geography with the study of man in relation to his environment, but textbooks and examination questions soon deflect him into the easy and well-beaten paths that result in mere memoriter work.

It is also a grave mistake to drop the work in geography in the seventh grade. This is quite a common practice in the schools of the state, and the result is that the study of geography is discontinued just at a time when the reasoning faculties of the pupils are developing, and at a time when the student could get the most value as well as enjoyment out of the work. The study of geography should be continued throughout the eighth grade. This is especially necessary when we consider that a large percentage of the pupils that go through the grades never pass into the high school, to continue geographical studies. For such pupils, as well as for others, geography is one of the most practical studies of the elementary curriculum, and the benefits resulting from its study should not be curtailed by discontinuing it at the end of the seventh year.

A few high schools organized on the junior-senior plan have introduced in the eighth year a practical course in elementary commercial and industrial geography. The work begins with the study of the geographic conditions bearing upon the commercial and industrial life of the community and of the state. From the community and state as a center, the work is extended to include the United States and foreign countries.

Physical geography or physiography as studied in the high school has developed into what might be termed an unrelated science, and is in much the same position that chemistry was in a few years back. It does not seem to lead anywhere or to have any practical bearing upon life or man's relation to the soil or climatic conditions. It has come to be largely a study of elementary geology.

Physiography can be made a very valuable high school subject, but its value in the high school curriculum will depend upon the extent to which it is related to the life and activities of the human race. Physical geography as now commonly taught, and senior geography, might well be dropped from the curriculum of the average high school, and the time given to a strong course in commercial and industrial geography, with enough of the physical geography to serve as a background for a proper understanding of the geographical facts bearing upon industrial and commercial life.



The above figure is from a photograph of a model about $3\frac{1}{4}$ feet square recently made for the University of Minnesota. It is based upon 4 quadrangles of the U. S. Geological Survey, 1 inch to the mile. The remarkably pitted surface with its many lakes is due to morainic deposits. The width of the valley of the Minnesota River (bottom of map) at once suggests that it was once the channel of a much larger river; this larger river drained Glacial Lake Agassiz.*

*The model is made and sold by E. H. J. Lorenz, Madison, Wis., from whom price and desired information may be obtained.

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The total daily capacity of the 303 mills in Minnesota is given as 165,715 barrels of flour, of which 84,600 barrels is from 23 mills located at Minneapolis and 5,900 barrels from 4 mills at Duluth. In addition to the Minnesota output there is a demand for 15,200,000 bushels of wheat from the North and South Dakota mills. Thus there is a local demand for 142,784,552 bushels of wheat in this immediate Northwest.

STATISTICS SHOWING THE GROWTH OF MINNESOTA

	1850	1860	1870	1880	1890	1900	1910
Population	6,077	172,123	439,706	780,773	1,301,826	1,751,394	2,075,708
Population of St. Paul	2,227*	12,150*	23,085*	41,473	133,156	163,065	214,744
Population of Minneapolis	750	12,849*	31,566*	46,887	164,738	202,718	301,408
Population of Duluth		406*	4,561*	3,483	33,115	52,969	78,466
Acres improved farm lands	5,035	556,250	2,322,102	7,746,693	11,127,953	18,442,585	19,643,533
Acres unimproved farm lands	23,846	2,155,718	4,161,726	6,156,326	7,535,692	7,805,913	8,032,290
Total value farm products in \$			33,446,000	49,468,000	71,238,000	112,420,000	185,832,000
Bushels of wheat	1,401	2,186,000	18,866,000	34,601,000	52,300,000	95,278,000	57,094,000
Bushels of corn	16,725	2,941,000	4,743,000	14,831,000	24,696,000	47,256,000	67,897,000
Bushels of oats	30,582	2,176,000	10,678,000	23,382,000	49,958,000	74,054,000	93,897,000
Bushels of potatoes	21,145	2,565,000	1,943,000	5,184,000	11,150,000	14,643,000	26,802,000
Tons of hay harvested	2,019	179,000	695,000	1,637,000	3,135,000	4,339,000	6,036,000
Pounds of butter	1,100	2,957,000	9,522,000	19,161,000	34,766,000	41,188,000	34,708,000
Value of all live stock in \$	92,000	3,642,000	20,118,000	31,904,000	57,725,000	89,063,000	161,641,000
Value of slaughtered animals in \$	2,840	751,000	3,076,000	887,000	2,544,000	7,810,000	25,753,000
Total annual value of manufactured products in \$	58,300	3,373,000	23,110,000	76,065,000	192,033,000	223,692,000	409,420,000
Cost of material used in manufacturing in \$	24,300	1,904,000	13,842,000	55,660,000	118,481,000	173,425,000	281,622,000
Value of flour and grist mill products in \$	500	1,310,000	7,534,000	41,519,000	60,158,000	82,988,000	139,136,000
Value of forest products in \$	57,800	816,000	4,538,000	9,368,000	30,018,000	42,689,000	42,352,000
Production of iron ore (long tons)	0	0	0	84-62,124	891,000	9,834,000	31,966,000
Miles of railroad	0	0	1,092.50	3,099.32	5,409.11	6,794.68	8,483.56
Percentage of iron ore produced of total for the United States				(1884) 1.5	8.47	43.3	56.19

*Includes the population of the whole county in which the city is located.

THE DEATH OF EDWARD VAN DYKE ROBINSON

A GAIN we are called upon to report the death of a valued member of our editorial staff:—Professor Edward Van Dyke Robinson who had within a few months accepted a chair of Economics at Columbia University. By a strange coincidence this report of Professor Robinson's death finds its place in an edition of this magazine devoted to the State in which he did his most mature educational work, Minnesota. Although he had been called to Columbia a few months before his death in December, his connection with the University of Minnesota extended back to 1907. Still earlier he was a principal of one of St. Paul's high schools. He was the author of a number of works, chiefly in the field of Economics, but including also a widely used high school Commercial Geography. He was a member of the Association of American Geographers and for nearly ten years was an associate or contributing editor of this magazine. Especially sad is the death of a man in the very prime of his intellectual life (49 years), finely equipped for a scholarly career, and just entering upon a promising new field of work in one of America's old and distinguished universities.

THE WEALTH OF MINNESOTA

Note—The following pages are excerpts from a paper by the late Professor E. V. Robinson, read before the Second Annual Meeting of the Minnesota Academy of Social Sciences at Minneapolis, Dec. 3-4, 1908; the entire paper is printed in the annual Proceedings of the Academy.—Editor.

THE first white men in Minnesota were Frenchmen, who came by way of the Great Lakes, (1659); and their motive was the fur-trade. Ten years before the Declaration of American Independence, there was a considerable settlement at Grand Portage, 146 miles from Duluth, where the canoe route from Montreal left Lake Superior for the Rainy River, Lake Winnipeg, and Great Slave Lake. Another early center of the fur-trade was at La Point, on Madeleine Island, near Ashland, Wis., which was for many years (after 1816) the seat of the Astor interests in the Northwest, and had intimate relations with Minnesota by way of the St. Croix River. The first settlers on the upper Mississippi were also connected with the fur-trade. In this class belong not a few men prominent in early Minnesota, notably N. W. Kittson, Henry M. Rice, Charles W. Borup, William and Allan Morrison, and H. H. Sibley. And the importance of the fur-trade was further enhanced when the Red River carts established connection (1843) between the Hudson Bay Company's factory at Winnipeg and St. Paul. These facts of history, taken in conjunction with the large areas of sparsely settled woodlands in

Minnesota, serve to explain why St. Paul is still the greatest primary fur market in the United States, and one of the greatest centers of fur manufacture.

The second economic motive which brought men to Minnesota was the lumber industry. Most of the early lumbermen were recruited from the lumber districts of Maine, and they transferred to Minnesota the lumbering methods which had been developed in northern New England: The first logs were cut for market on the St. Croix in the winter of 1836-37; and just ten years later, lumbering began on the Rum River, a tributary of the upper Mississippi. Mills were soon built at the falls of these rivers, and immense quantities of logs were also rafted down the river as far as St. Louis. At Moline, Rock Island and other river towns, mills were built especially to saw logs from the St. Croix. The lumber industry in fact brought to Minnesota most of the people, aside from those connected with the fur-trade, who were here in territorial days. Minnesota lumber not only built up many towns on the Mississippi and its tributaries, but by reason of its cheapness and accessibility, it was a powerful factor in the rapid settlement and development of the prairie regions to the south and west.

Agriculture began late and under unfavorable auspices in Minnesota. There were, it is true, some farms here even in territorial days; but they were subsidiary to the lumber camps, and did not even meet the local demand, so that food had to be imported. Horace Greeley of the New York Tribune, who did much to prejudice people against this northern country, alleged in justification that it "imported loafers, the food they ate and the whiskey they drank." Moreover, until the Treaty of Traverse des Sioux in 1851, settlement was practically confined to the timbered region between the St. Croix and the Mississippi, the prairie section being still held and jealously guarded by the Sioux. This section was indeed first made known, even to people already settled in the territory, by a series of steamboat excursions up the Minnesota River in 1850. Mr. J. J. Hill has recorded that even so late as 1856, when he first came to Minnesota, the territory was considered good only for lumber, cranberries and fur. The first wheat to reach outside markets, according to Mr. Hill, was shipped down the Mississippi in 1857, the year before Minnesota became a state; and the first flour, also, according to Mr. Hill, was shipped from Minneapolis in 1862, being branded "Muskingum Mills, Troy, Ohio," in order to command better prices. The leading primary wheat market was at first Rochester, later Red Wing, and then Minneapolis. The great Red River district, which received its first agricultural settlers away back in 1811 (the Selkirk settlement from Canada) did not become a factor in wheat production until after 1870, when it secured railroad connection with Duluth.

Within the space of a dozen years, the pioneer type of agriculture which prevailed in Minnesota as elsewhere on the frontier, and whose purpose ^{was} was to produce everything possible upon the place, gave way to special wheat farming for the market. This sudden development on so gigan

plans calls for the keeping of considerable live stock. About 1884, therefore, the dairy industry began to appear in southern Minnesota, doubtless in imitation of Iowa and Wisconsin, which had previously passed through the same crisis and found their economic salvation in the dairy herd. In subsequent years the dairy industry has spread toward the north, where the great ice sheet left large areas of sandy and stony land better suited to grass and root crops than to grain. And in the district between the Mississippi and St. Croix rivers, north of the Twin Cities, wheat farming has been largely abandoned in favor of potatoes, this district forming the famous Minnesota potato belt. Only the Red River Valley still depends almost exclusively on wheat as a market crop.

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THE SPECIAL MINNESOTA NUMBER

This issue of the Journal contains 96 pages. The edition consists of over 6000 copies, the largest edition we have ever printed. Professor Posey and his staff of contributors have performed a genuine service to geography and education in Minnesota, and outside of Minnesota as well. The Journal of Geography is pleased to be able to place in the hands of Minnesota teachers and others such a valuable handbook of geographical information. A few hundred extra copies have been printed and may be secured, while they last, at the following prices:

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MINNESOTA

MEMBERSHIP IN THE NATIONAL ORGANIZATION OF GEOGRAPHY TEACHERS

You may already know that at Washington last December the final organization of the National Council of Geography Teachers was completed. The Journal of Geography has been made the official organ of the new association; all geography teachers are invited to affiliate themselves with the organization. Dues will be, for the present at least, \$1.00 a year and each member will receive the Journal of Geography without additional cost. The following blank may be sent to V. C. Finch, Treas., Madison, Wis., or to George J. Miller, Sec., Mankato, Minn.

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I desire to make application for membership in the National Organization of Geography Teachers. Enclosed find one dollar for annual dues. Please send the Journal of Geography to the following address:

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AN EXPERIMENT IN FOURTH GRADE GEOGRAPHY

By Mary E. Kelton of The Veltin School, New York, and
Caroline W. Hotchkiss of The Horace Mann School, Teachers College,
New York

IDEAS of education are in the last stages of the great transition that has been in progress for a generation. We are on the threshold of "The Schools of Tomorrow" that have recently been depicted in the volume bearing this title. Geography, perhaps, more than any other subject, offers opportunity for the *natural* development of the mind, but we have been slow to recognize this. For a quarter of a century our colleges and normal schools have been creating a widespread interest in geography, but though this subject has an honored place in university faculties, and college professors have written text-books full of interesting geographical information, geography in the elementary school is still chiefly taught by memorizing instead of providing the child the chance for growth and discovery.

The following lessons represent an earnest effort in three schools to teach geography in the fourth grade according to the powers and needs of the child. These exercises have been given, not for the purpose of imparting a mass of information, but to equip the child with the tools of learning he will need in order to acquire such knowledge for himself.

The children come to the fourth grade with a general idea of the world and of the countries that furnish them with the necessities and luxuries of life. They have simple notions of the relations between climate, crops, and industries. They have been to the markets where their food is bought, and to the dock where ships from the other side of the globe come in. In the fourth grade their text-books are a good atlas and carefully chosen pictures, the sky and its phenomena, and the fields where they play. Geographical readers are their reference books. The Atlas with its colored maps and oddly ruled Index awakens the curiosity of every normal child. To use the book, however, it is necessary to learn its symbols; therefore the first of the following exercises are directed toward this end.

DIRECTION AND LOCATION

When the child first locates himself on a map or globe he asks countless questions about its various lines and symbols. Such questions determined the choice of *meridians* as the topic of the first lessons. In an outdoor lesson at noon the children compared the direction of their shadows with the compass line, and holding their rulers vertically drew on sheets of paper north-south

lines. Our local meridian was then drawn on the school room floor. The meaning of *meridian* was explained and it became the topic of an English lesson. The following sentences were dictated as a spelling lesson, after the difficult words had been studied:

DICTATION LESSON

My shadow at noon always falls on a meridian. At noon my shadow always points north. If I should walk north as far as I could I would reach the North Pole. If I should walk south as far as I could I would reach the South Pole.

After this, sun dials were made—two children working together. Four inch squares of heavy cardboard with upright pins were used in the construction, and the direction of the morning, noon, and afternoon shadows was drawn. We played simple games to test the ability of the children to face in any direction on the local meridian line.

"John may walk two steps north, two steps south, and one step east." If John performs successfully he may give a direction to another child.

GLOBE LESSON IN LONGITUDE

The naming of the local meridian led to simple lessons in longitude. The size of each (we called it its *waist measure*) was explained and the idea of *scale* and *degrees* taught from the globe. Degrees, minutes, and seconds were compared with hours, minutes, and seconds on the clock face. For purposes of rapid calculation we considered a mile as the distance of a minute of longitude. A map of New York City was placed on the floor so that two local meridians coincided, then the name of the New York meridian $73^{\circ} 59'$ was given. It interested the children to know that this line passed through our City Hall, and later, some of them, counting twenty-two blocks to a mile, estimated the exact location of the school in minutes of longitude. At this point the Atlas was presented for the first time and opened to the Mercator map. Stories of Mercator and the making of his map were told. When the meridian of Greenwich was found the children noticed how the meridians were numbered, and found where their meridian could be drawn on the map.

THE MARINER'S GAME

The next arithmetic lesson was given to the drawing of the parallels and meridians of a Mercator map. Sheets of lined paper were used, the blue lines being numbered as meridians thirty degrees apart, the edges of the sheet thus becoming 180° E. and W. The Equator and the parallels 30° and 60° N. and S. were drawn and the network called the streets and avenues of the ocean, for in the development of the idea of the division of the world in *East* and *West* we had used the plan of the naming of our own city streets for comparison. An enlarged copy of a Mercator map was drawn on the black board,

the Equator in red, the Prime Meridian in blue. A captain, first, second, and third mates were chosen, and three able-bodied seamen. The captain was provided with a paper ship drawn by one of the children.

The Play—

Captain: "First mate!"

First Mate: "Ay, ay, sir." (Gives naval salute).

Captain: "Place ship at 60 N. and 30 W." (Gives ship to mate).

If the first mate fails to place the ship quickly and correctly, he is deposed and the second mate takes his place and the game proceeds. This game was played at morning exercises arousing much interest and amusement. It can be varied as the ingenuity of the teacher and children may suggest.

MAP EXERCISES

The following exercise on the map of North America was worked out in class. Map 9 of Longman's Atlas was used and the children filled out the blanks on the mimeographed sheet.

Ex. I. *Meridians and Countries.* Map 9.

1. The one hundredth meridian passes through
..... and
2. The eightieth meridian passes through and
.....
3. The fortieth parallel passes through
4. The sixtieth parallel passes through
..... and
5. The meridian passes through the Panama Canal.

During these lessons easy problems were given in dividing 360 into halves and quarters and in calculating (one degree equals approximately sixty miles) the distance of places from the Equator, thus emphasizing the actual size of the earth.

Ex. II. *Meridians and Countries of North America.*

On an outline map of North America the meridians and parallels found in the first exercise were drawn in color. The name of each country crossed was also written on the map.

The Index.—The Index of Longman's Atlas is a valuable part of the book. To teach a child how to use it is to equip him with a ready means of obtaining much information for himself, and to acquaint him more thoroughly with the meaning of a map. Printed slips containing names of cities were given. These cities were chosen because of their location on or near a crossing of meridians and parallels. The children found the cities in the Index as

In the next lesson the colors of the map were explained. Highland and lowland can be only relative terms to a fourth grade child, but if a beginning such as is suggested here is followed up a map will surely mean something more than a kaleidoscope of colors peppered over by dots and lines. The nearness of New York children to the shores of Long Island and New Jersey make the symbols for deep and shallow water easy to understand. For the explanation of sea-level there was our immediate environment to draw from, our own school being less than a hundred feet above that level, and the Palisades about three hundred feet. For higher regions there were many pictures and the children's own experiences to help us.

*Ex. V. *North America, Colors and Meaning.*

The ——— Ocean is shallow water.

The Atlantic Ocean is ——— water.

——— Bay is shallow water.

Gulf of ——— is deep water.

The ——— River flows through lowland.

The ——— River flows through highland.

New York City is situated on ———.

In an effort to make the meaning of a map still clearer, one or two lessons were given using large pictures of various land and water forms. These pictures (colored lithographs of the *Holzel Charakter Bilder* Series, E. Steiger and Co., New York) are a valuable aid to the teaching of geography in all grades, not only for this general work, but also for definite illustrations of well known localities and types of plant and animal life.

The first picture given to the children was that of a snow-capped mountain range. A stream with its tributary flowed down the slopes and on either side of the little river was a strip of farming land with evergreens fringing the river bank. Green meadows interspersed with rocky knolls climbed to meet the snow lines. A companion picture gave an extensive view of the Sierra Nevada Mountains, their forested slopes, a narrow stream far down in the valley, a cliff and waterfall in the foreground, a road following the stream, and various signs of habitation on the cleared slopes.

In the discussion of these pictures the following points were made: The mountains were high, the stream started far up on the mountain slopes (source), and in one case was fed by melting snows. The term *mountain range* was learned; a peak was found; the tributary traced to its mouth; the valley pointed out; a favorable site for the farmer's house selected, near enough the sheltering trees, but out of the way of spring floods. The farmer would keep cows and would make butter and cheese. In the narrow valley few people would live, there being few roads and no bridges, and very little farming land.

*See Leete's *Exercises in Geography*, Longmans Green & Co.

Then the map of the United States was examined for mountain ranges and peaks; the Sierra Nevadas were located, the source and mouth of a river, a river flowing in a narrow valley, the Colorado, a stream flowing in a broad valley, the Sacramento.

Another picture showed two mountain lakes fed by mountain streams, a lower lake being fed by the stream from the upper lake. From this picture we turned to the map again and found Lake Champlain between the mountain ranges, and the stream flowing from the lake into the St. Lawrence. We named the Great Lakes and their connecting bodies of water. Using in this way picture and map the following geographical features were discussed and their representative symbols on the map, as far as could be learned.

- A mountain range and peak
- A river, its source, mouth
- A valley, meadows where cattle can graze
- A stream fed by melting snows
- A good place for a farmer's house
- Land between two lakes
- River flowing out of a lake
- River connecting two lakes
- A narrow valley where few people live
- A broad valley where many people live
- A rocky coast, a sandy coast
- A bay, bold headlands.

Lighthouse, Capes and Peninsulas—

At this point we recalled the mariner and his Mercator map. Our sea-board children were ready with facts about the dangers to ships in approaching land in storm or fog. We searched our local map for lighthouses, light-ships, and buoys. We drew lighthouses, told stories about them, and made a collection of pictures to show how our government helps ships to keep out of danger. The map of North America was examined to find suitable places for lights and buoys. We examined folders of the Ward and Savannah S. S. Lines which show the majority of the lights on our eastern and southern coasts. Then the following exercise was given:

Ex. VI. *Lighthouse Capes.* Maps 9, 11.

<i>Cape</i>	<i>Ocean</i>	<i>Country or State</i>
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During the working out of this exercise the fact was noted that capes often mark the opening of a gulf or bay, that a river often empties into a bay, and further, that cities were frequently at or near the mouths of such rivers, or at the head of a bay. We traced many rivers from their sources to their mouths, found the symbols for the head of navigation, then made lists of rivers under the following headings:

Ex. VII. *Rivers and Bays.* Maps 11, 13.

<i>River</i>	<i>Gulf or Bay</i>	<i>City</i>	<i>Country</i>
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We did not lose track of world happenings while pursuing this scheme of work. On an outline map of the United States we colored each state that sent a food ship to Belgium, naming its seaport, if any, tracing route of ship, and locating ports at which they would touch. Then followed a few lessons which aimed to show in a simple way the influence of the surface of North America on its settlement.

HOW THE EXPLORERS ENTERED NORTH AMERICA

The following points were made, the history lessons for this grade being largely stories of the exploration and settlement of North America.

1. Hudson's expedition to the New World.

This involved the location of England, Amsterdam, Norway, Iceland, Greenland, Newfoundland, Chesapeake Bay, Delaware River, New York Bay, Hudson River, Albany, Hudson Bay.

2. De Soto's discovery of the Mississippi.

The earlier discoveries of Columbus and Vespucci were referred to, the Spanish sphere of exploration and settlement found, and De Soto's story told and his route traced.

3. The French in North America.

By means of the excellent large scale maps of north-eastern United States in the Atlas we traced the route of the French explorers and fur traders up the St. Lawrence and Great Lakes. The alluring hunt for the "Great River" was described, and the canoe trips of the French leaders from Green Bay across the portage of the Fox River to the Wisconsin and Mississippi were traced step by step on the map. The children learned that the French were not farmers and made little use of the fertile soil of the vast prairies which they discovered.

4. The pushing of the English across the Appalachians.

The settlement of the Dutch and English along the Hudson as far as the head of navigation at Albany was recalled; then we traced their path up the Mohawk along the Indian trail to Lakes Ontario and Erie. The hold of the English home-maker on the land was emphasized. This prepared the way for the study of the great farming country of the Middle West, this study beginning very properly with the activities centering about wheat.

Conclusion.—We are now in the second year of this experiment. We believe that we have broken away from a study of words to learning by doing. In English and History our pupils get most of their knowledge from the printed page, then reproduce it. Geography offers a rich opportunity to learn in a more natural way. We should be glad to know if other teachers think that the suggestions offered here hold possibilities for their pupils.

THE CORAL REEFS OF THE HAWAIIAN ISLANDS

By Vaughan MacCaughey
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THE Hawaiian Islands, situated in the north mid-Pacific, are remarkable for the simplicity of their rock formations. There are only two general classes of rock in the entire archipelago,—lava and coral. The almost wholly submerged tiny islets that constitute the western end of the chain,—Laysan and Midway, for example,—are composed entirely of coral rock and sand. The volcanic island of Hawaii, as large as Connecticut, that forms the south-eastern terminus of the group, is built up wholly of lava, with practically no fringing coral. The intermediate islands strikingly illustrate the various graduations between these two extremes,—the old islands, deeply eroded and with extensive coral reefs; the young islands, with active or recently-extinct volcanoes, large tracts of fresh lava, and scant coral formations.

My first visit to a coral reef, when I came to Hawaii eight years ago, made an indelible impression upon my mind. The tropic morn was fine and clear, the trade winds unusually quiet, and the tide at lowest ebb. All conditions were most favorable for a detailed examination of the reef. My comrade and I embarked in a native outrigger canoe, and paddled from the famous Waikiki Beach, near Honolulu, to the surf-lines of the outer reef. We were clad in bathing suits and provided with collecting apparatus and "water-boxes,"—glass-bottomed boxes, by means of which the sunlit transparent waters can be readily examined.

Arriving at a suitable location, where the water was only two or three feet deep, we anchored the canoe and prepared for wading. We were equipped with old shoes to protect our feet from the jagged, broken coral branches, (which cause very painful and slow-healing wounds); with broad-rimmed hats to protect eyes, face, and neck from the intense glare of the sun and water; with geological hammers for breaking off fragments of coral; and with sundry haversacks, bottles, wide-mouth vials, etc. With our water-boxes as guides we wandered for three delightful hours over the ledges, knolls, and sandy pockets of the reef; collecting, exploring and rejoicing in the luxuriant abundance of marine life of every form and color. Branches of living coral; many kinds of curiously shaped shells; bright spotted crabs and crustaceans of various sizes, spiny sea-urchins; spidery-armed brittle-stars; exquisitely beautiful hydroid colonies; purple and black sea-cucumbers; delicate marine algae of many genera,—reds, browns, olives, and greens of varying tints,—a kaleidoscopic succession of queer marine organisms. Gorgeously colored fishes, small and large lurked in the pools, and evaded prolonged inspection. It is impossible to describe the profound impression produced by one's first sight of the wonderfully strange and fascinating reef-world beneath the waves.

The majority of newspaper-reading people are familiar with the name of Pearl Harbor, the site of the United States' greatest and most important

Pacific naval base. Few, however, realize that the landlocked security of the "Gibraltar of the Pacific" is due to the inestimable labors of the coral-producing organisms of bygone ages. The extensive lowlands that, save for a single narrow channel, surround the harbor, are ancient coral reefs, now elevated a few feet above sea-level. The city of Honolulu itself, the "Cross-Roads of the Pacific," is built upon an uplifted coral reef. Honolulu Harbor is merely an enlarged streamway through the reef; were it not for the fresh water, the coral would have formed a continuous barrier.

Although of striking beauty and interest, the Hawaiian reefs do not attain the magnitude nor the spectacular effects of the great reefs in the South Pacific. There is nothing in all the world, for example, to compare with the Great Barrier Reef of Australia. Hawaii is subtropical rather than tropical and the coolness retards the full development of the coral reef just as it somewhat retards the coconut, the breadfruit, the mango, and other trees that reach their finest growth in the South Seas. In Kaneohe Bay, however, a few miles from Honolulu, are the widely advertised Hawaiian "Coral Gardens," and these, with the gorgeously colored fishes that inhabit the reefs, amply reward the traveler for his journey across the Oahu Mountains.

The reefs of Hawaii, in their intrinsic beauty, in their wealth and variety of marine life, in their economic importance to the ancient Hawaiians as fishing grounds, and in their contribution to the geologic history of the archipelago, hold an important place in any consideration, however cursory, of the natural history of this remote and isolated island world.

HOW LIBRARY WORK, FIELD WORK, AND LABORATORY WORK MAY BE MADE MUTUALLY SUPPLEMENTAL IN THE TEACHING OF EARTH SCIENCE*

By H. D. Grose

Township High School, Joliet, Ill.

THAT there frequently is opportunity for a closer correlation than is customarily attempted between library work and the regular forms of work in the teaching of Earth Science in the High School is obvious, even to the most casual observer. That such a correlation may be seriously worth while is indicated by the fact that the time of the entire Conference, of which this Earth Science Section is a part, has been assigned to a consideration of the potential contribution of the Library to the various phases of secondary school instruction.

A very simple device will readily indicate what an opportunity exists for a more extended correlation of library work with field and laboratory work in

*Abridged from a paper read before the Earth Science Section of the Annual Conference between the University of Chicago and Affiliated High Schools, April 16, 1915.

the teaching of Earth Science. Construct and apply a small personal catechism, somewhat as follows:

Do I ever make use of current literature bearing on topics in hand or previously discussed?

Do I encourage my pupils to find and bring in such material for themselves?

Do I know what my High School library or the local town library affords on the subject?

Are the replies which we will have to make disconcerting?

Granted an opportunity for a more extended use of library facilities in connection with the field and laboratory work, the questions naturally arise:

Is such work useful and worth while?

What may we hope to gain by it?

Will the gain be commensurate with the effort expended?

The scope of the present paper will not permit of extended argument; probably such argument is unnecessary to establish the validity of the following claims. Hence, at the risk of seeming at once optimistic and categorical, we present the following enumeration of some of the results which may legitimately be expected from a correlation of library work with the field and laboratory work in the teaching of Earth Science:

1. *Added interest*, resulting from varied form of presentation.
2. *Emphasis*, resulting from varied angles of approach.
3. *Opportunity for practice in checking results* by comparison with those of recognized authority.
4. *Enriched fund of information* attainable from a given problem.
5. *Increased significance of problem* resulting from establishment of enlarged relationships.
6. *Extension of the pupil's viewpoint* by carrying him beyond the limit of his teacher and his text-book.

7. *An increasing acquaintance with sources of information.* Whether such results are worth while or not may be determined by the answer which we should have to give to the question, "Why is teaching?"

The attempt to enrich Earth Science teaching by aid of the library will necessarily require some measure of time, as in the publishing of assignments and references, and in the giving of reports. But this time demand is by no means burdensome or prohibitive. No matter how limited or how liberal the time allowance may be, some considerable effort on the part of the teacher is involved in making the library a successful aid. At the outset, and probably for a considerable time when dealing with ninth-graders, the library assignments should be made as definite as it is possible to make them. To say that the general topic is discussed in Chapter V of ———— *Physical Geography*, is usually a waste of time. If Chapter V happens to cover twenty pages or more, the pupil is almost sure to be swamped in a sea of verbiage. He grows discouraged at the initial drenching, and cannot again be easily induced to venture upon deep waters. But let the assignment at the outset be given in

the form of a problem or specific question, with definite reference to page and section, or, if need be, to paragraph and line, so that the pupil can readily find the definite thing for which he is searching. You will then find that the pupil not only returns in triumph with his catch, but that he is willing, nay, eager to go again to sea. Later, having gained confidence, and a little more familiarity and skill he may be entrusted to cruise more widely, with fewer channel markers to guide him. Finally he may be sent on his voyage with only the names of the books which are to be his ports, leaving him nothing but their indices as the charts by which to lay his course. But at the risk of seeming redundancy let it be here repeated that for beginners *the library assignments cannot be made too definite*. Give a definite problem, and a definite reference containing the desired information. The young people are thereby saved much time which would otherwise be spent unnecessarily in random and in probably fruitless reading. Of still more importance, the young people are spared initial discouragement, and are given, instead, the satisfaction gained through accomplishment. By such a procedure the library may be made really supplemental to the regular forms of teaching.

How this may be accomplished is perhaps best indicated by means of a specific example, taken from class-room experience. To insure what the lens-grinder would call clear definition, we have selected one out of a group of short studies used in presenting to ninth-graders the general topic *mantle-rock*. You are not required to agree with the method of procedure as a good teaching process; it is described to illustrate the point in hand because it gives results when carried out as described. The particular topic selected deals with peat. The idea is to give the young people an understanding of what peat is, of how it is made, for what it is useful, and of the significance of the occurrence of peat-bogs.

In the laboratory is made a preliminary study of peat from the text-book. From this study, the young people learn that peat is the result of the partial decay of vegetable matter under the water of ponds and marshes; that it is apt, therefore, to occur in more or less horizontal beds; and that it can be burned as fuel. This preliminary text-study is illustrated by means of stock-specimens of several varieties of peat. One of these is burned in a little brazier. The pupil is now able to recognize peat—sometimes—by sight; he knows that it will burn; and he has a group of second-hand facts about it that still remain to be verified.

He now goes on a field trip to a neighboring peat-bog, presumably without knowing that it is a peat-bog until he has arrived at the site and examined the exposure. Among other materials in the exposure he shortly recognizes peat. Furthermore, he finds, in this instance, two layers of it, separated by a considerable layer of some other material which in the laboratory he learned to name marl. One of these peat layers, fortunately, contains fragments easily recognized as partially decayed plant material. Thus he verifies at least two of his second-hand facts. Unfortunately for future classes, and usually to the olfactory annoyance of the present one, he finds re-confirmation of the com-

bustibility of peat, for this particular bog has been smouldering lustily for several seasons, and this year the fire has so thoroughly undermined the exposure usually visited as to practically destroy it.

That peat on decomposition may yield a fertile and hence useful soil is indicated by the fact that on the decayed surface of the upper peat bed is found a rich growth of grasses and herbs. In its present form this bog will not demonstrate, save by inference, that peat is formed in or under water. It is here that the library may further supplement the laboratory and field work thus far done. Several references may now be given to be read for this point, as well as for further information.

To summarize: The pupil has gained in the laboratory some fundamental concepts of peat, together with certain second-hand facts about the substance. His concepts and certain of his second-hand facts have been emphasized and verified in the field by a study of peat in place. He has in the library extended his information about peat, and he has related that information to life by discovering, through reading, in what ways peat is directly and indirectly useful to man. Thus the topic becomes an intellectual unit, more or less thoroughly a part of the pupil's mental stock-in-trade.

Other methods of handling the problem through these three avenues of approach will readily suggest themselves, varying with available facilities, the problem in hand, and the personal equation. Other references will likewise readily be found with a little search. This search for reference material should not be limited to text-books, but should reach out into the whole field of literature. Government reports, fiction, cyclopedias, periodicals, atlases, almanacs, pictures, daily papers, maps, advertising matter, all may be profitably drawn upon for illustrative material.

The search for library material, and particularly the systematizing of it for use, will occasion no inconsiderable expenditure of effort on the part of the teacher. It is not to be expected of course, that such a plan will greatly appeal to the individual who "is not permitting professional growth to interfere with his social obligations." But to the teacher, keenly interested in both subject and pupil, the collection and assimilation of such material is not a task, but a never-ending delight. Often, too, the pupils may greatly assist in the collection of material, once they are shown how to go about it. The presence and the use of an index in a book is often a revelation to them, and a thing well worth teaching. Such a correlation of library work with the field and laboratory work is one of several efficient means of bringing the young people to see that Earth Science is not a thing that can be stereotyped between the two covers of a text-book, but that it is an ever growing field for observation and enjoyment.

MAN'S COMPLETION OF NATURE'S SUPREMEST EFFORT ON THE GREAT PLAINS

By Charles Keyes, Geologist
Des Moines, Iowa

THE great legal battle which is now being waged between the two great states of Kansas and Colorado over petty water-rights of an insignificant stream, the Arkansas river, presents some features which are novel in the extreme, but over which human courts can never have jurisdiction. Under conditions of less enlightened civilization the conflict for one side or the other would spell war to extermination. The real grounds of this silly state quarrel repose in an antiquity so remote that man himself had not yet made his appearance upon the face of earth. It is a feeble and final echo of one of Nature's cataclysmic contests.

Reclamation of the desert by irrigation of our arid lands of the West introduces a number of unusual elements into the local affairs of mankind. Fundamentally these factors are directly economic. Some of them possess broader aspects; for they give rise to generalizations that are purely scientific in character. Most instructive and suggestive is the geographic trend of some of these themes.

In all ages and in all places man is wont seriously to regard himself as unrelentingly at war with his surroundings. At all times and at all points Nature seems to him to stand resolutely in the way of the accomplishment of his fondest hopes. When, then, man chances somewhere to work towards the same end that Nature is the incident is worthy of more than passing notice. On the Great Plains of the North American continent man today unwittingly is actually exerting himself most strenuously to put what is really the finishing touch on one of the grandest geologic achievements with which we are acquainted.

Geographically the Great Plains region possesses singularly attractive interest that has been heretofore little considered. Constituting the western half of the broad Mississippi basin the region forms a belt of country, the extent of which equals one-third of the total area of the United States. Northward it extends unbrokenly far into Canada; and southward it continues far into Mexico. By physiographers, rigidly schooled under conditions of eastern environment, this vast tract of plain is commonly treated as a region rapidly undergoing general leveling and lowering towards base-level in the ordinary course of a normal geographic cycle. Recent critical examination and quantitative measurement conclusively show that these inferred conditions do not really exist. Instead of being an area of rapid degradation it is actually a region undergoing notable aggradation. The gradation balance is strongly positive rather than negative in character.

Unlike that third part of the United States lying east of the Mississippi river, where the streams are wearing down towards base-level all positive features of landscape about as fast as they do anywhere else on the face of the

globe and about as rapidly as they ever do, the thousand-mile belt of plains country spreading out to the westward of the great water-course is nowhere undergoing active normal denudation as has been so generally assumed. The streams of this broad tract are far from doing normal corrasive work. They are not producing net results in their favor.

Between our boundaries with Canada and Mexico, a distance of more than 2000 miles, only five master-streams leave the Rocky Mountain front. Four of the five are quite inconsiderable. The fifth, until very recently, discharged its waters into Hudson Bay instead of the Gulf of Mexico as at present. These rivers surely have relatively little influence in their efforts to base-level so vast a region as the Great Plains, with a round million of square miles of area.

Although today the Missouri river—the fifth of the master-streams mentioned—supplies one-half of the sediments which the Mississippi river carries annually to the Mexican Gulf it has never played more than a very minor role in the history of the Great Plains. Only since the continental ice-sheet in the Dakotas blocked its way to the north have its waters been turned southward. How insignificant must be the combined efforts of the other four streams. Small wonder is it that the recent elaborate measurements by the Government of the sediments discharged at the mouth of the Mississippi river give such an excessively and surprisingly slow rate for the general lowering of the continent.

There is another factor which the Government estimates on the rate of continental denudation do not take into account. It is the enormous accretion of sands and dusts derived from western deserts, which occupy another one-third of the area of the United States, where general stream-corrasion is almost unknown, and where wind-scour appears to be a denuding agent more powerful than rain, river, or ocean. Occupying a leeward position to these arid lands the Great Plains expanse is preeminently an area of wind-laid deposits. This is amply shown by the fact that these deposits over much of the region are now more than 1000 feet thick. Against such prodigious deposition the five-streams corrasion makes not even locally appreciable headway.

Ever since early Miocene times, as the geologic records disclose, there has been a strong tendency for the Great Plains to grow higher in place of lower. The contest to push back the streams, to completely eliminate them from the region, to extend the western deserts farther eastward, has gone on steadily until the number of rivers which once took their origin in the Rocky cordillera and the waters of which once reached the sea, may now be counted on the fingers of one hand. The efforts of dessicating climate to dry these rivers up, of thirsty soils to drink them in, of their own excessive sediments to choke them, of desert dusts to enshroud them, and of wind-driven sands to obliterate them, have been at last in our geological time all but successful. And now comes man in his pride, and by his great irrigating projects, lays bare to the action of the eolian powers the river beds themselves.

The final touch to Nature's grand achievement, an unremitant labor

lasting through long geologic ages, becomes in our day and by our connivance an accomplished fact. Man actually steps in and completes in this vast region the prodigious work which Nature set out energetically to do in Early Tertiary ages, and since Miocene times has bent all her energies to fulfill.

A FEW SUGGESTIONS ON FIELD TRIP WORK

By Louie C. Kelley

John Marshall High School, Richmond, Va.

A FIELD trip of the following type can be taken by almost any school and, when well planned and well executed, is of the greatest value.

Before taking the trip, the pupils should bring notes from their parents giving permission for such work; the object of the trip must be clearly explained; an outline given to the pupils showing the principal things to be observed; car fare and lunches are brought when necessary.

No trip should be undertaken unless the instructor knows the ground thoroughly; knows what points he wishes to emphasize and has his class under good control. The discipline is not that of the school-room but one that allows freedom in conversation and movement, provided that they do not annoy other tourists and are attentive when the instructor is giving directions.

Notebooks must be carried in which to record the observations which are to be incorporated in a report within a week after the trip is taken. These reports may be handed to the English teacher also as a part of the theme work. In a good-natured way, the instructor moves from one group of pupils to another calling their attention to the beauties of nature and engaging in conversation with them. At the same time a certain amount of reserve is necessary if she would control without seeming to do so. At all times the instructor has in mind how to cover with interest the greatest amount of work with the greatest economy of time and energy.

THE TRIP

The object of this trip was to study the effects of weathering and stream action.

We took a ride of about twenty minutes by trolley to one of the beautiful natural parks. As soon as we arrived there, weather observations were made and then a walk down a steep hill brought us to a group of springs which outcropped at the base of the hill. The explanation of these springs was asked for; how the water compared in taste and appearance with the river which we had just seen; what is the value of these and other springs.

The overflow from the springs gave rise to a small stream which, flowing down the slope, was rather swampy. Later, a steep-sided valley had been cut. When have we heard of a similar valley? What effect would such a valley have on travel and settlement?

As we walk along the banks of the stream we find a tiny fall of the direct type, a miniature Niagara. This fall is due to an outcrop of granite—the bed rock of this region. What is meant by the “Fall Line”? Why is Richmond a manufacturing city?

Some pupil has discovered another outcrop of granite away from the stream. To what class does this rock belong? Of what minerals is it composed? What changes are taking place? What are the weathering agents here? Which mineral decays first? Which is unchanged?

A short distance away is a large quarry from which this rock is being taken for building and monumental purposes, road construction, etc. What are some great granite-producing states? Why should Richmond be a larger producer of granite products?

Call attention to the different ways in which soil is being formed. Notice the subsoil. Do we understand what a farmer means by sub-soiling?

Going back to the stream, we notice that there are numerous curves and that the stream develops a steep slope on the outside and deposits the sediment on the inside of the curve. Why? Here the work of weathering and undercutting has given us a mature valley. Compare the valley of the Ohio with that of the Colorado in its effect on travel and occupation. At the base of the hill is a talus slope which is the result of creep and gravity. What becomes of this material?

Notice the effect of vegetation on soil wash. This is a good point at which to discuss the value of forests in the conservation of soil and rainfall. Some pupil calls my attention to a deep hole in the bed rock of the stream. How was this pot hole formed? Did we not see similar ones when crossing James river? Notice the character of the pebbles in the hole. The valley sides are now nearly flat and the stream has developed many meanders. What course will the stream take in time? Then an ox-bow lake and cut-off will be formed. How was this flood plain formed? Can we find any tiny levees? Discuss the advantages and disadvantages of life on such a plain.

The stream has now reached old age and is dropping its load of tools in the lake. The heaviest material is deposited first and far out at the front of the delta, notice how fine is the silt that is being deposited on the floor of the lake. What kinds of rocks would be formed from these sediments? The stream has many distributaries, each building its own levees and delta. Tell of the work of building artificial levees and jetties along the Mississippi, and of the disastrous floods. What products could be raised here?

Look around the lake and tell me what changes are taking place here? How was this lake formed? What will be the future if the sediment and vegetation are allowed to remain?

What causes the breeze in this valley? We notice how the waves and currents are building miniature Coronado beaches, Willoughby Spits, Sandy Hooks and other well-known shore forms.

Many of the pupils blink their eyes as the water reflects the light. So, too, when they look across the lake at the bare hillside with many gulleys. What effect would vegetation have on that hillside?

At every turn we notice the beautiful coloring of the trees, the moss on them and many other interesting things. None of these are of value, however, if they are not made practical. The pupil must see through the eyes of the instructor.

At no time does an instructor have such a wonderful opportunity for knowing her pupils; their interests and ambitions. After a trip of this character, her work will be interesting and her class responsive.

FLOODS AND FAMINE IN CHINA*

By Daniel W. Mead, C.E.

University of Wisconsin

FROM as early as 2300 B. C. to the present time, Chinese history tells of many great floods which have frequently devastated vast areas of China. . . .

The floods of China are caused by the heavy rains which result from the typhoons that during the summer, from June to September, sweep from the southern seas northwesterly over China, and frequently cause a concentrated downpour over extensive areas of the Great Plain. These floods, and the consequent famines, are of frequent occurrence and result in disasters always of local and often of national importance. A famine in 1877 and 1878 is said to have caused the death of 8,000,000 of the inhabitants of Honan, Shansi, Shantung and Chihli. In recent times, every year has recorded occurrences of this kind of more or less severe nature, with more notable disasters at intervals as frequent as 1901, 1906, 1910 and 1911.

This last wide spread disaster occurred in the Huai River region, which lies between the Yangste and Hoang Ho or Yellow River. . . . The inhabitants of this valley, with few exceptions, have been kept in great poverty by these frequent floods and few have anything laid by for the days of famine which follow the floods. When, as is often the case, the crops are almost totally destroyed, the people not only suffer severely with great direct loss of life, but they are brought face to face with actual starvation, with the resulting famines to which is attributable greater loss of life in the past than from the direct results of the floods themselves.

The last great flood of 1910, followed by a severe famine in 1911—together with a lesser flood in the same year—brought great suffering to this region. Great efforts were made by the formation of famine relief committees to relieve this suffering so far as possible, and the American Red Cross Society expended over \$650,000 in this work. Following this great calamity,

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the Red Cross suggested to the Chinese Government the advisability of taking some action looking toward flood prevention or the amelioration of these flood conditions; and based on a mutual arrangement, Mr. C. D. Jameson, an American engineer who had spent several years in China, was employed to make a reconnaissance of the flood region and to suggest tentative plans for the work. Following Mr. Jameson's reconnaissance, and after lengthy negotiations which were greatly hampered by an attempt of the Belgians to secure a concession for this work, the Chinese Government granted a concession to the American Red Cross to finance an undertaking for the work of improvement of the Huai River, through American bankers, contractors, and engineers.

On presentation of this matter to the New York financiers, the bankers demanded as a prerequisite to undertaking the same, that an examination of the entire project be made by a board of hydraulic engineers. The board appointed for this purpose consists of Lieutenant Colonel, now Brigadier General William L. Sibert, who was one of the Panama Canal commissioners and who had direct charge of the design and construction of the Gatun locks and dam; Arthur P. Davis, Chief Engineer and now also Director of the United States Reclamation Service; and the writer.

The board proceeded to China, leaving this country on June 9, 1914, and reaching China the latter part of the same month. Three months were spent in examining the region and it was found perfectly feasible, by opening a suitable channel to the Yangtse and by the construction of various canals and dikes, to greatly improve the flood conditions as well as to accomplish other marked improvements on the condition of this region.

The betterments which will obtain from the plans outlined will include the reclamation of 500,000 acres of land now permanently inundated by the Hungtse Lake, with provisions for the irrigation of 350,000 acres. It will also include the permanent betterment of about 2,000,000 acres immediately north of the lake, and the permanent prevention of overflow on about 5,000,000 acres of the lowland east of the Grand Canal, which in the past has been frequently devastated by these floods. This last land embraces the richest rice land in Kiangsu Province and the region is one of the most thickly populated in China. The improvements suggested include also adequate means for the irrigation of this vast area, and a permanent improvement of the navigation facilities in the Grand Canal from the Yangtse north to some distance above Tsingkiangpu on which an important traffic has existed for centuries and which has been seriously interrupted annually both by floods and low water.

Much of the flood district in the Anhui Province, well backed from the channel of the Huai River, would not be reached directly by the improvements proposed, and can be improved only by extensive collateral works of a local nature which would have to be initiated at a later date, but for which work adequate outlets would be provided in the plans proposed.

The work proposed would cost about \$30,000,000, to which would have to be added, for interest during construction, financing, etc., about \$15,000,-

000, bringing the total expenditure to \$45,000,000, which would not be an extravagant price for the resulting improvements which in themselves would readily pay the entire cost if properly administered; in addition to which would result the great saving in life and suffering which now occurs at frequent intervals.

The Chinese themselves have no conception of the basic principles which are necessary for the successful consummation of such project as I have described. Those advocates of the great value of practical experience per se, can find little consolation in China, where 4,000 years of practical experience without one idea of the theory or basic underlying principles has brought the country, hydraulically, to a chaotic condition. As an example, a Chinese authority had previously suggested as a relief to this great region, an outlet channel approximately 125 feet wide and 10 feet deep, where the Board of Engineers found it necessary to have a channel 2,000 feet wide and 23 feet deep.

The magnitude of some of the engineering works accomplished by the Chinese people in the forty centuries of their history, is to here impressive. These works are, however, as a rule impressive from the vast amount of labor involved rather than from the fundamental design or character of the construction, although in many details the character is admirable. The Great Wall of China, stretching perhaps 2,500 miles from the sea into the interior of the country; the Grand Canal, approximately 800 miles in length from Hanchow to Tientsin; perhaps 100,000 miles of smaller canals which cover the lowlands along the sea and rivers like a great network; the great Ming Dike, faced with cut stone, that crosses the country for 35 miles from the Grand Canal at Tsingkiangpu to the southern extremity of Hungtse Lake, the extensive dikes of the Yellow River (control of which, in my judgment, is one of the most serious engineering problems of the world today), while in many cases seriously defective in fundamental design, show what the Chinese people can accomplish by organized effort.

Very little effect of the recent severe famine was evident on our visit to the Huai River region in 1914. The recuperative power of the Chinese people is astonishing. No man can come closely in contact with the educated Chinese without being impressed by their great intellectual capacity and mental ability. Conservative in character, educated in the past along the line of the Chinese classics (which, however, compares favorably with the old Greek and Latin education of our own country), steeped in superstition, reared to a reverential regard for institutions developed largely from the teachings of Confucius, with individuality long subdued by the customs of the country, the Chinese people can hardly be expected to at once step into the sisterhood of nations, fully equipped for the intelligent government of their own people along Western lines and the immediate successful development of the great resources of their country. China already has been seriously hampered in its dealings with Western nations that consider themselves civilized but have in the past exacted concessions that the Japanese of today, who are skilled imitators, are simply carrying to a greater extent.

The capacity for great development undoubtedly exists in the Chinese people and is amply demonstrated by their past history; their intelligence and ability can not be successfully questioned. They already recognize their needs of education and development along Western lines, and if left without serious handicap, their ultimate successful development, while possibly not so rapid, will be equal to, and in my judgment, of greater value to the people of the world than the present development of civilization in Japan.

COMMERCIAL NOTES

(Excerpts from *The Americas*)

CONDITIONS IN CUBA

AS the present calendar year draws to a close we find the island of Cuba enjoying the greatest prosperity she has ever known in her history. Business everywhere is on the increase, and new lines are constantly being established and extended. Trade relations with the United States are naturally very close, and at present that country is supplying the bulk of the island's import trade besides taking nearly 90 per cent of its exports, but there are even greater opportunities open to American manufacturers and the time is ripe for developing new business and pushing sales.

The present extraordinary prosperity of this island is of course entirely due to the successful sugar season just closed and the high prices obtained for the crop. The final figures which have recently been compiled by local statisticians for the year 1914-15 show that 176 centrals have been grinding during the season, with a total production of 18,148,669 bags, or 2,592,667 tons, having an estimated value of approximately \$204,000,000.

The outlook for the coming sugar crop is brilliant. Weather conditions have been excellent and continue most favorable. The cane fields, which are now ready for cuttings, have an unusually good appearance. Lack of excessive rainfall at this season when the cane has been rapidly maturing will have the desired effect of increasing the density and higher percentage of glucose in the juice and proportionately increase the yield of sugar.

OUR TRADE RELATIONS WITH CHINA

China's foreign trade has doubled in the last ten years; the possibilities for the next ten are limitless, for China today presents the greatest opportunity in the world for commercial and industrial development. With a territory of over 4,000,000 square miles and a population estimated at 300,000,000 to 400,000,000, China has immense untapped mineral resources and less than 6000 miles of railway. The imagination can hardly grasp the commercial significance of the transformation of China into a modern nation, with 600,000 miles of railroad instead of 6000, with an adequate system of canals and high-

ways, with hundreds of busy factories and mines, and with thousands of acres brought into more fruitful cultivation by scientific farming.

China's net foreign trade in 1914 amounted to \$630,000,000. Though ranking third among the nations that supply the needs of the great Eastern Republic, the United States claimed only 7.3 per cent of China's import trade (only 1 1-3 per cent of our total exports), as contrasted with 20 per cent for Japan and 50 per cent for the British Empire. Moreover, our trade with China during the last decade has remained practically stationary: that of Japan with China has increased threefold.

INTERESTING FEATURES OF ENGLAND'S WAR-TIME COMMERCE

England's commerce as it is figured in raw statistics compares very unfavorably with her more or less normal foreign trade in 1913. For ten months of this year the balances are \$1,000,000,000 to the worse, shown alongside 1913, imports being \$600,000,000 bigger and exports \$400,000,000 smaller, the "unfavorable" balance being about \$1,900,000,000 instead of about \$950,000,000. This takes no account of imports of fighting materials, which do not appear in the Board of Trade returns.

The financial press of London, in analyzing the returns, makes no attempt to minimize the gravity, in connection with the finances of Great Britain and their bearing on the war, of certain features in the figures. There is a high proportion of imports for unnecessary consumption, they say. Increases of imports, month by month, are becoming larger.

THE REMARKABLE GROWTH OF JAPAN'S FOREIGN TRADE

The commerce of Japan with the rest of the world will bear some watching inasmuch as that country is making a determined effort to increase it, and is every year adding a few new countries to her list of customers. A trade commission is now on its way visiting country after country, diplomatically opening the discussion of better commercial treaty relations.

The figures of trade for eight calendar months (ended August 31) have arrived from Japan. They show that this year's aggregate of sales of Japanese products abroad was \$213,205,647, against \$205,709,032 in the same time last year. Japan's premier export product is silk, of which she exported \$123,948,180 worth in 1913, \$94,458,446 worth being raw silk.

THE FOREIGN TRADE OF CANADA

The foreign trade of Canada has been something of a replica of that of the United States as a result of the war. In the seven months ended October 31, the value of exports of Canadian products was \$326,430,000, \$100,000,000 more than in the same months of 1914, \$80,880,000 more than in the same period of 1913. A great surplus of the crop is still to go forward.

Imports have declined from \$390,544,000 in 1913 to \$253,107,000 in 1915, converting an adverse balance of \$145,000,000 into a favorable balance of \$73,323,000.

War orders have had their part in this. Manufactured products exported have increased from \$39,000,000 last year to \$84,000,000 this year.

HOW NORWAY PROFITS BY THE WAR

Norway's war-time business is one that takes the form of a great and lucrative increase in an already established industry. She is obtaining a greatly increased direct and *entrepot* trade and her good ships are bringing in great wealth to the nation.

The Norwegian fleet is one that is frequently cited as having the lowest first costs and operating expenses of all the maritime transportation equipments of the Western nations. She has a tonnage of 2,700,000, only a tenth of which is occupied with purely Norwegian business, the other nine-tenths being in the service of general world-trade.

Being already in the business, and neutral, Norway has been obtaining an enormous income from her ships since the war began. Many of her shipping companies have, in the past six months, paid out 40 and 50 per cent in dividends. It is reported that some of her shrewd ship-owners have paid for the cost of their ships after a few voyages. Shipping stocks on Norwegian business are up over 100 per cent. Up to date, about 40 Norwegian vessels have been lost in the waters of the war zone, but insurance has paid for them.

COTTON SEED

Until a few years ago cotton seed was practically a waste product, used only for making fertilizer and cattle food. In 1876 there were but four mills in the United States engaged in crushing cotton seed. Today there are 872 such mills, turning out a product valued at more than 150 millions of dollars, practically one fourth the value of the cotton crop of the country. The oil crushed from the seed is worth \$229,000,000, and even the hulls are worth over eleven millions.

A recent bulletin of the Census Bureau lists 81 different uses of the products secured from cotton seed. If cotton is king, the seed is a high ranking prince of the royal house.

R. E. D.

RAINFALL NEEDED BY VARIOUS CROPS

The rainfall of the United States in relation to various crops has been investigated by B. C. Wallis (*Month. Weather Rev.*, June, 1915, pp. 267-274), who has grouped the states as cereal, cotton, northeastern, central eastern, west coast, and mountain states. The rainfall is considered from the viewpoint of the agricultural year. The rainfall requirements of the various staple crops are clearly stated. Winter wheat requires 22 to 32 inches during a growing period of 10 months. Spring wheat requires about four months and a rainfall of 13 to 15 inches. Winter rye requires about 27 inches during 10 months. Spring barley is best suited by about three months' growth and 10

inches of rainfall. Maize flourishes with about 18 inches in about four months. Tobacco apparently needs about 14 inches of rain during a growing period of about three months near to midsummer. Cotton is best suited with about 20 inches, during a growing period of about 4 2-3 months. Outside the cotton belt, no states can provide these conditions during the hottest months.

R. DeC. WARD.

OUR GREAT PHOSPHATE RESERVE

A grave problem for the farmer is to discover the needs of his depleted or unfavorably proportioned soil. Its greatest need may be phosphoric acid, one of the three substances that are most necessary in maintaining fertility, the other two being nitrogen and potash. Phosphoric acid for use in fertilizers has been supplied for many years in part by the phosphates of Florida and Tennessee and from islands in the Pacific Ocean. These deposits can not always supply the demand, and therefore the recent discovery that the Rocky Mountains contain the largest known area of phosphate rock in the world is of vital interest to future generations, if not to the present one.

In 1909 and succeeding years these phosphate deposits were systematically examined by the United States Geological Survey, and in 1910 phosphate rock was discovered in Montana. On January 1, 1915, the total area of phosphate lands in Montana, Utah, Wyoming, and Idaho withdrawn from entry was 2,713,155 acres. This phosphate reserve is larger than any similar area in the United States; it is, indeed, the largest area of phosphate rock yet recognized in the world.

ISLANDS IN A SEA OF LAVA

The valley of the ancient Snake River in Idaho was flooded with great outpourings of black lava, which spread out sheet on sheet, buried the old land surface, and partly filled the valley with molten rock, which solidified and has remained to this day undisturbed except for the gorges that the streams have cut in it. In some places old mountains project through the petrified lava flood as islands project above the surface of the sea, and old ridges stick out into it as capes and promontories.

The area covered by the Snake River lava is about 20,000 square miles. So far as is now known, there is but one lava field in North America of greater extent, the Columbia River lava field, which covers about 200,000 square miles. In Snake River canyon below Shoshone Falls nearly 700 feet of horizontal sheets of lava are exposed, but whether this is the maximum thickness or not can not be told. (Overland Guidebook, Bulletin 612, U. S. G. S.)

An average of 95 tons of soil and loose rock is washed into the ocean every year from every square mile of the United States, according to the Geological Survey. This estimate does not include the Great Basin. The immensity of this contribution may be better comprehended when it is realized that the surface of the United States covers 3,088,500 square miles.

THE ORGANIZATION OF THE NATIONAL COUNCIL OF GEOGRAPHY TEACHERS COMPLETED

The final steps in the formation of the National Council of Geography Teachers were taken in Washington, D. C., on Dec. 31, 1915. Gathered at the annual meeting of the Association of American Geographers were representatives from states all the way from North Dakota to Massachusetts. A tentative constitution was adopted and referred to the Executive Committee to be more completely worked out.

The following officers were elected for the year 1916: Prof. R. E. Dodge of the Teachers' College, New York, president; Prof. Albert Perry Brigham of Colgate University, and Prof. Charles R. Dryer of Indiana, vice presidents; Prof. George J. Miller of the Mankato, Minn., Normal School, secretary; Mr. V. C. Finch of the University of Wisconsin, treasurer.

The constitution provides for a Board of Directors consisting of (at present) fifty members and also an Executive Committee selected by the Board of Directors.

Prof. Miller, the newly elected secretary, will continue the work of building up the state organizations. He reports that fifteen states have completed such organizations and that ten more will probably be added to the list during the present year. A list of the 38 state leaders already appointed will be found below.

The American Geographical Society of New York, with its accustomed generosity, has voted one hundred dollars to the National Council for clerical expenses. This is a fine act and will be of great assistance to the Council in carrying on its work. Doctor Bowman, Director of the American Geographical Society, is actively supporting the new teachers' organization and is a valuable friend.

It is expected that the leaders in the various states will have the fullest freedom in carrying on their local work. In fact, the actual work is to be done by state and local societies. The Executive Committee does not expect to actively initiate or push the work, except through suggestion and recommendation. The best results will be secured by leaving to the state and local societies the fullest freedom and placing upon them the responsibility for the efficiency of the work which they undertake. The actual benefits to geography teaching must come from the studies, discussions, and inspiration of the local groups. The success of the movement will depend mainly upon the vigor and initiative of the state and local leaders. The Executive Committee and other national leaders will keep in touch with members through the pages of the *Journal of Geography*. From time to time, suggestions on the work of constituent societies will be offered. Reports of the activities of the state councils will be gladly received and printed. There is evidence that school geography in the United States is entering upon an upward movement.

STATE REPRESENTATIVES OF THE NATIONAL COUNCIL APPOINTED UP TO
JAN., 1916

- Maine—Professor E. E. Philbrook, State Normal School, Castine.
New Hampshire—Mr. G. H. Whitcher, Deputy State Superintendent of Schools, Concord.
Vermont—Supt. Walter H. Young, St. Johnsbury.
Massachusetts—Professor L. O. Packard, Boston Normal School, Boston.
Rhode Island—Professor Robert M. Brown, State Normal School, Providence.
Connecticut—Professor Chas. E. Pratt, State Normal School, New Britain.
New York—Professor Alice Wessa, State Normal School, Buffalo.
Pennsylvania—Professor G. B. Roorbach, University of Pennsylvania.
Maryland—Professor Ernest E. Race, State Normal School, Baltimore.
Virginia—Loulie C. Kelley, John Marshall High School, Richmond.
West Virginia—Prof. C. T. Boggess, State Normal School, West Liberty.
North Carolina—Professor Collier Cobb, State University, Chapel Hill.
Kentucky—Professor R. P. Green, State Normal School, Bowling Green.
Tennessee—Professor Chas. C. Colby, Peabody College for Teachers, Nashville.
Georgia—Professor Frank Merrill, State Normal School, Athens.
Alabama—Professor C. W. Daugette, President State Normal School, Jacksonville.
Louisiana—Professor F. V. Emerson, State University, Baton Rouge.
Ohio—Professor Frank Carney, Denison University, Granville.
Michigan—Professor Mark Jefferson, State Normal College, Ypsilanti.
Indiana—Professor B. H. Schockel, State Normal School, Terre Haute.
Illinois—Miss Mabel Stark, State Normal University, Normal.
Missouri—Dr. A. E. Parkins, University of Missouri, Columbia.
Wisconsin—Professor W. J. Sutherland, President State Normal School, Platteville. (Since deceased.)
Minnesota—George J. Miller, State Normal School, Mankato.
Iowa—Professor E. J. Cable, State Teachers College, Cedar Rapids.
North Dakota—Professor Howard E. Simpson, State University, Grand Forks.
South Dakota—Professor Willis E. Johnson, President State Normal and Industrial School, Aberdeen.
Nebraska—Professor N. A. Bengtson, University of Nebraska, Lincoln.
Kansas—Miss Jane K. Atwood, Emporia State Normal School, Emporia.
Oklahoma—Professor Chas. H. Taylor, University of Oklahoma, Norman.
Montana—Professor Grant E. Finch, Normal School, Dillon.
Colorado—Professor George A. Barker, State Teachers College, Greeley.
New Mexico—Alvan N. White, State Superintendent of Public Instruction, Santa Fe.

Idaho—Professor Joseph Reed, State Normal School, Lewiston.

Utah—Professor Anna Youngberg, University of Utah, Salt Lake City.

Washington—Professor J. E. Buchanan, State Normal School, Cheney.

Oregon—Professor Warren D. Smith, Dept. of Geology, University of Oregon, Eugene.

California—Professor James F. Chamberlain, State Normal School, Los Angeles.

NEWS NOTES

Mr. O. W. Freeman of the Fergus County High School, Lewiston, Mont., has an interesting paper on "Geographic Influences Affecting Distribution of Population and Character of Industries in Montana" in the January *Inter-Mountain Educator*.

At the meeting of the Southern Wisconsin Teachers' Association, Feb. 12, Prof. R. H. Whitbeck discussed "The Teaching of Geography in the Grades."

Prof. O. D. von Engeln and L. A. Hausman of Cornell University, have an illustrated article on "An Automatic Intermittent Eruption, Artificial Geyser" in the February *School Science and Mathematics*. The methods of constructing and operating the apparatus are described.

At the meeting of the N. E. Minnesota Educational Association at Duluth on February 8th, a Geography Round Table was conducted. Miss Grace Chase presented a paper on "Some Opportunities for Problem Teaching in Geography" and Prof. Eugene Van Cleef gave an illustrated address on "Our Debt to Climate."

THE MASSACHUSETTS COUNCIL

The Massachusetts Council of Geography Teachers has chosen an Executive Committee which is to serve as the administrative board of the State Council. This Committee is made up of members representing the colleges, the normal schools, the high schools, and the elementary schools.

The Executive Committee has had conferences with the Superintendent of the Boston Schools and with representatives of the State Board of Education. These conferences have been helpful in indicating possible lines of work and in showing that school officials are more than willing to cooperate with us.

We are making a determined effort to have Geography represented on the program of the State Teachers Association although the subjects presented at former meetings of this Association have been very general in character. In this attempt we are being aided by school officials of strong influence. We expect that an opportunity will be offered for an address on some aspect of Geography at the coming meeting in November.

LEONARD O. PACKARD,
Representative for Massachusetts.

THE ASSOCIATION OF AMERICAN GEOGRAPHERS

At the meeting of the Association of American Geographers in Washington on Dec. 31 and Jan. 1, Prof. R. E. Dodge's presidential address dealt with the subject, "Some Problems in Geographic Education with Special Reference to the Secondary School." It was a masterly presentation of the subject and ought to be made available to every teacher and school man interested in Geography. The members of the Association were entertained at luncheon both days by the National Geographic Society. The Washington members of the Association had arranged an exhibit of government cartographical work and methods. The walls of several rooms were hung with specimens of the many kinds of map work which the government departments are producing.

At the regular sessions, twenty papers were presented, eleven by representatives of educational institutions, eight by men from departments of the U. S. Government, and one by an explorer.

Professor Mark Jefferson of Ypsilanti, Mich., is the president-elect.

ACTIVITIES OF CALIFORNIA GEOGRAPHY TEACHERS

The Bay Council of Geography Teachers includes all interested in geography teaching in Oakland, Berkeley, Alameda and San Francisco. This is a branch of the National Council and was formed at the N. E. A. meeting last summer. Monthly meetings are held for the discussion of geography teaching and geographic materials.

A feature of the winter's work is an exhibit in which it is proposed to gather representative materials—books, apparatus, maps, etc., which will be available for use in the grades and high schools. Comments and criticisms are to be made on the material and a report will be published later. This exhibit will be made a feature of the geography work of the State Teacher's Association meeting which will be held in San Francisco in April. Considerable interest is being manifested in the plan and publishers are giving their cordial co-operation. One feature that will be of much value but rather difficult to work out well will be the exhibit of material valuable in teaching which can be secured free or at a trifling expenditure from manufacturers and advertisers.

Among those who are contributing to make this work a success are H. W. Fairbanks, of Berkeley, Prof. R. S. Holway, University of California; Principal Preston, Franklin School, Berkeley; Principal Cohn, Porter School, Alameda; Miss Etta F. Ogden, Oakland Intermediate School; Mrs. Addie M. Clark, Washington School, Oakland; Principal John A. Imrie, Le Conte School, Berkeley. The General Chairman is Earle G. Linsley, Mills College, and the Secretary, Miss Lucille Hewett, Alameda High School.

RECENT PUBLICATIONS

CIVILIZATION AND CLIMATE. By Ellsworth Huntington. xii+333 pp. 6x9 inches. Published by the Yale University Press, New Haven, Conn. 1915. \$2.50 net.

Dr. Huntington has become widely known for his work in the general field of climate in its relation to man and to history. The thoroughness of his investigations must command respect even if some of his conclusions are not accepted. His studies in Asia, in Central America, and in western United States have made him a fixed believer in the great influence of climate upon mankind.

The present book is full of interesting material, on the whole, conservatively stated. Every page stimulates thought. Anthro-geographers are accused of making sweeping generalizations and of ignoring all but geographical factors. Huntington has plainly tried to avoid these errors. He says (p. 221) "I do not delude myself with the idea that the problem of the relation of climate to civilization is solved. Far from it." On p. 249 he says, "This hypothesis is so new that there has not yet been time for it to be fully discussed and tested by large numbers of workers. Therefore the reader must be cautious about accepting it." Closing his chapter on the White Man in the Tropics he says: "Along with the social aspect of the question, and neither more nor less important, goes the physical."

It may be contended that the author already had certain convictions regarding the relation of climate to mankind, and that his new findings are sure to be in accord with these convictions; but *Civilization and Climate* does not impress the reader as being either warped or distorted. The facts are presented and the author's interpretation of them is given. The reader is also free to interpret them.

For example, the tests of the effect of weather on the efficiency of certain mill operatives and students are highly suggestive, but they are not assumed to be conclusive. The agreement of the two maps (Figs. 25 and 28) one showing the distribution of climatic energy and the other the distribution of civilization in the United States is not assumed to prove a strictly causal connection; the portion of the United States indicated as having the greatest climatic energy is also the region surrounding the *developed coal mines*; also that having a large sub-stratum of *New England stock* in the population. On the whole, however, the agreement between the map of high civilization and that of high climatic energy is too close to be ignored. On p. 218 the author says, referring to these maps, "They do not indicate that climate is the only factor in determining the condition of civilization or even the main one. Far from it. Yet they indicate that it is as essential as any other. Today civilization seems to make great progress only where a stimulating climate exists."

Climate may not *directly* cause all of the differences in civilization for which it is, after all, responsible. Favorable climate induces many conditions which in their turn advance civilization. Education, a high type of religion,

good government, and all kinds of social uplift, are more pronounced in a good climate, and all of these *social forces* join their uplifting influences with that of climate and intensify its beneficial effects. These social factors represent capital accumulated under favoring climatic conditions.

The great variety of angles of approach and attack employed by the author is impressive:—lake fluctuations in Asia and in California; the location of ruins in Asia, in Central America, in arid United States, and elsewhere; the big trees of California; the fluctuations of glaciers, the records of factory operatives and of students;—such an array must carry some conviction with those who are open to conviction.

The book is a highly valuable contribution to a great question. It is sure to be attacked at one point or another by both friends and opponents; but that will be evidence that thoughtful people regard it is worthy of attack. It is a proper source of gratification to American geographers that one of their number is so persistently attacking a great scientific problem and that his researches are attracting widespread interest among scholars in other fields.

R. H. W.

COMMERCE AND INDUSTRY. By J. Russell Smith. viii+596 pp. Henry Holt & Co., New York, 1916. \$1.40.

This new work from the hand of Professor Smith is, in the main, the subject matter of his *Commercial and Industrial Geography* wholly reorganized and considerably abbreviated. In this new form the excellent material which characterizes the larger work will doubtless find greater use as a text for briefer courses in secondary and normal schools. Among the features which commend this book for class use are (1) organization of material upon a regional basis, and (2) the addition at the end of each chapter of a list of thought-provoking questions,—the type of questions which may not be answered by reference to any particular section of the text. More than half of the book is devoted to the agricultural, mineral, and manufacturing industries of the United States. Among the foreign countries, Latin America and the Orient receive much attention because of our future trade expansion in those regions. The last 50 pages are devoted to a discussion of world commerce. The book has the same wealth of illustration which characterizes the larger volume. We cannot commend the unsatisfactory type of vertical bar used for representing comparative values. Moreover, there are, as in the larger work, statements which lack strict accordance with fact, as on p. 228 where we find that "flax fiber districts have no valuable by-product of seed."

On the whole the book is a valuable addition to the list of elementary commercial geographies, if for no other reason, because it departs from the compendium type of text with which teachers are more than familiar.

V. C. F.

THE EDUCATIONAL MUSEUM OF THE ST. LOUIS PUBLIC SCHOOLS. By Carl G. Rathmann, Ass't. Sup't. Schools. U. S. Bureau of Education, Bull. No. 48. Whole Number 622. 1914. 15c.

"To make the child acquainted with the world in which he lives, we must bring him into personal contact with the world." This logical statement introduces an interesting discussion of a very vital factor in the lives of the children of the public school system of St. Louis.

The Educational Museum had its inception with the close of the St. Louis World's Fair of 1904. "The board of education and the superintendent . . . appealed to the exhibitors to donate parts of their displays to the public schools." Contributions have since been made by other museums, by some of the U. S. government bureaus and by private parties. The Museum began its work in Oct., 1904.

Many exhibits have been prepared for circulation among the schools. The teacher requests certain exhibit material for a given week. It is delivered to her on a regular delivery day. Any exhibit she has on hand and which she needs no longer, is returned. Thus, every week she may have different exhibit material that may actually be handled by the students rather than looked at from a distance. Such specimens as are too fragile or too large, of course are not circulated, but may be viewed at the permanent headquarters of the museum. The exhibits are grouped according to the course of study in the schools.

The bulletin is well illustrated to show the exhibits in use, as well as a few of the exhibits themselves. In the 35 pages there is much suggestive matter that will prove stimulating to the teacher. The work of the museum deserves close study with a view to the adoption of a similar plan by all teachers who are not now so fortunate as to possess a museum.

EUGENE VAN CLEEF.

GEOGRAPHY OF THE FOX-WINNEBAGO VALLEY OF WISCONSIN. By R. H. Whitbeck. Wisconsin Geological and Natural History Survey, Bulletin No. XLII. Cloth, 105 pages, 6 chapters, 28 plates and 25 diagrams.

This is the first bulletin of a series that is to be devoted especially to the industrial regions of Wisconsin. The method of describing a region is clearly set forth in the introductory pages and in the six chapters these principles are closely followed. The explanatory description of the origin of the Fox-Winnebago Valley is concisely done and clearly develops the importance of the river as a waterway and as a valuable source of power. These two items of waterpower and navigation are more fully discussed in chapters three and four, for it is the presence of these resources that has determined the chain of cities from Fond du Lac to Green Bay. The fifth chapter is given to the chain of cities, that have developed in this lowland, and their industries. Each of these Wisconsin cities is of a definite type and its development is shown to be under the same influences as those that have controlled the growth of similar cities in other regions of the world. Fond du Lac is a commercial city,

Oshkosh a lumber center of the first magnitude, Appleton is centered about the single industry of paper making, and Green Bay, from the days of Jean Nicolet, has been a port city.

W. M. GREGORY.

THE NEW RUSSIA. By Alan Lethbridge, xv+309 pp. E. P. Dutton & Co., New York, 1915. \$5.00 net.

The book does not seem to merit its title or its price. It is mainly made up of a traveler's experiences and impressions and adds little to our knowledge of Russia. So much space is devoted to profitless details of the journey and comments upon matters of small interest to anyone but the author, that the substance of the book is greatly diluted. The reader does not feel that the author's judgments are of any great value because they are based upon brief and necessarily superficial observations. The present war is supplying the excuse for printing many books that have no other excuse for being. The public, and particularly the libraries, have a right to something more substantial in a 300-page book sold for \$5.00.

THE FUTURE OF SOUTH AMERICA. By Roger W. Babson. 407 pp. Illustrated. Two folded maps in colors. Little, Brown and Co., Boston, 1915. \$2.00 net.

Mr. Babson is a statistician and writer on financial matters. His book is the outgrowth of a recent tour of South America. He writes as a business man to business men, yet his book is full of facts and impressions which would enliven the teaching of South American geography. The book is no mere traveler's narrative filled with insipid personal experiences. It is crammed full of information, partly gained at first hand, but more largely culled from other men's writings, yet well digested and vigorously written. Since no small part of the information collected had to be taken on the authority of others, some misinformation necessarily has crept into the book. Such is probably the "reported" mountains of pure crystal salt in Santo Domingo and the 300,000 pupils enrolled in the schools of Uruguay whose total population is put down as only 1,100,000.

The author finds little love for us in Latin America and little disposition to buy our goods in preference to European goods. He sharply criticises our methods of doing business in South America and sees no great increase in our proportion of South American business until we send better qualified salesmen, offer goods made according to the preferences of our customers, pack the goods better, have better steamer service and give more liberal credit.

The Comstock Publishing Co., Ithaca, N. Y., has just issued *The Plant Note Book* by Anna Botsford Comstock of Cornell University. It is one of the Note Book Series issued by this company. Others of the series are *The Bird Note Books I and II*, *the Tree Note Book* and *The Fish Note Book*, 30c each. *The Plant Note Book* contains:

Rand, McNally and Co. have recently issued *Panama and Its Bridge of Water* by Stella Humphrey Nida. It is a supplementary reader in Geography and history, narrating the whole story of Panama and the Canal from the first coming of the Spaniards to the present day. 196 pages, 50 cents. Profusely illustrated.

THE GEOGRAPHICAL REVIEW

In December, 1915, *The Bulletin of the American Geographical Society* concluded volume XLVII, and ceased publication under that name. In January, 1916, the Society's magazine appeared in new form and under a new name—*The Geographical Review*. Mr. Cyrus C. Adams, for the past seven years editor of the Bulletin, withdrew from active editorial direction of the magazine. Dr. Isaiah Bowman becomes director of the editorial staff, assisted by W. L. G. Joerg, Leon Dominian and G. M. Wrigley. The subscription price remains \$5.00 a year.

In shape and size, in style of cover and quality of paper, the new *Review* is a marked advance over the corresponding features of the old *Bulletin*. The new magazine is attractive in every way. The articles in the January number are of high quality, excellently illustrated. About one-third of the space is devoted to Notes, Reviews, and Geographical News and Items.

In his introductory announcement the editor says: "The Geographical Review hopes to serve the cause of education. Because the physical forces of the earth are so intimately bound up with human affairs geographical science should have a prominent place in our educational system. . . .

"To become still more useful to education, the Society's staff has been organized for the systematic development of the best geographical material from all parts of the world. Over six hundred periodicals, either primarily geographical or containing material of geographical interest are received each month. These are now thoroughly worked over and the results published in classified form. Probably no other geographical society carries on work of equal thoroughness and range at the present time."

The American Geographical Society is doing valuable work. The generous terms upon which it cooperates with the Association of American Geographers, its cordial attitude toward the new National Council of Geography Teachers, and its broad gauge policy in all particulars, are admirable. The new magazine promises to give American geographers a scientific periodical equal to the best in Europe.

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SOME PROBLEMS IN GEOGRAPHIC EDUCATION WITH SPECIAL REFERENCE TO SECONDARY SCHOOLS*

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IT may seem at first superfluous to devote this address to the discussion of problems in geographic education when more than one half the members of this association are engaged in teaching geography, or some phases of the subject, in our higher institutions. Having, however, worked many years in the shadow of both geography and education—as it were, in the umbra of the one and the penumbra of the other subject—my energy has been devoted increasingly to the consideration of those problems which involve the effective co-ordination of educational theory, practise and ideals and the ideals of the professional geographer and professional teacher of geography. I have realized more and more fully as the years have passed that we shall never have effective geography teaching until geographers and educators come to understand each other better, are more sympathetic each toward the other's viewpoint, until they realize that their ideals have many factors in common, and that effectiveness can be secured only by team work. The time has passed when in education, sports, or even in life, the star player can afford to sacrifice the success of the "team" to increase his vanity or promote his dignity. . . .

Time will not permit any presentation of the experiments performed and tests made by the many workers who have contributed to the evolution of experimental psychology from a philosophy into a science. Suffice it to say that established principles of education, of which the new attitude of educational leaders toward the question of mental discipline is an instance, have brought about new and in general more efficient methods of teaching in our better elementary, secondary and normal schools. . . .

On the whole, however, progress is being made. . . . We must look forward, and if we believe geography can be aroused from the state of arrested development in which it has so long lain dormant, we must join forces with all who can contribute scientific truth or accurately tested experience to the solving of the problems of such deep interest to all, and work for success as never before. Geography will come to its own when it is *proved* to be worth while in education. To make geography worth while we must not only scrutinize our methods of teaching from the educational standpoint, reevaluate its parts, and perhaps the subject as a whole, but also pay attention to the edu-

*Excerpts from presidential address delivered before the Association of American Geographers, Washington meeting, December, 1915. Printed in full in *School and Society*, Vol. III, pp. 253-265, Feb. 9, 1916.

cational movements that educational leaders, professional and political, are actively and effectively promoting.

Three movements of great significance, all vitally affecting the status of geography in elementary and secondary schools, have within the last few years come to the front in educational discussion and educational administration. They are the junior high school, the adoption of general science courses in the earlier high-school years, and the project or the problem method of teaching, not only science, but other subjects.

Perhaps the most far reaching and significant movement of recent years has been the development of the junior high school which may be "defined as a special organization of grades 7 and 8, or 7, 8 and 9 to provide for greater differentiation of studies, better care of individual pupils, an easier transition to high school, longer school life, etc."¹

By this system of organization some subjects, like mathematics beyond arithmetic, foreign languages and commercial and industrial studies can be begun earlier in school life, the abrupt change in methods of school work customary where the high school follows after the eighth grade is avoided and children are kept interested in the work because content and methods change as their powers increase and ambitions develop with the oncoming of adolescence. Already reports of the success of junior high schools from many cities show statistically a great increase in the number of pupils that remain in school beyond the sixth or seventh grade. This division between the grade school and the high school, which has so long remained untouched, is disappearing like a mist before the breeze or sun.

How does this affect geography teaching in schools? Generally in one of two ways. Either continental or regional geography is dropped at the end of the sixth year of the elementary school or it is carried unchanged or modified into the first year of the junior high school—the old seventh grade. If the former plan is followed the systematic study of geography that *every one* may or might find useful is dropped just at the time when the increasing abilities of well-trained pupils make it possible for regional geography, whether taught by old methods or new, to be really a contribution to life preparation. In some schools geography in the junior high-school years is devoted to the elements of commercial and industrial geography, and no all-round regional study is given. Children are again "fed, clothed and sheltered" as they have been perhaps several times in the earlier years of school geography. Owing to the lack of good texts and equipment and to the inadequate training of the teachers, the work often becomes less serious and satisfying than the work it displaces.

When regional geography is continued in the first year of the junior high school, it is usually made somewhat commercial in flavor and fills a need that all recognize as worth while. At present the best work for junior high schools has yet to be found. The problem is before us and any consideration of

1. Report Commissioner of Education, Vol. 1, p. 147. Washington, Government Printing Office, 1915.

science work, including geography, in secondary schools must take account of this movement and be organized accordingly.

General science is a title that today looms large in educational discussion, and under it is included the work in science for the earlier years of the old type high school and the upper years of the newer junior high school. Only six years ago a committee of the National Education Association² recommended a year course in geography for the first year of high schools, "about one half to be devoted to the larger topics in physical geography, and that the remainder of the year be given to a study of North America and Europe." This recommendation varied but little from those of a report made to this association in 1910.³

Since then general science, or elementary science, has come in with a rush so impetuous that even its promoters have been swept from their feet and have found some difficulty in readjusting themselves. The effect has been in many cases to crowd geography from the curriculum. . . .

The problem method of teaching, founded on proved psychological principles, and advocated by our keenest philosophical thinkers in education, is making every educational worker in each great field of study stop, look, think—and then think again.

The junior high school is requiring an organization of high-school geography work to meet a new need. General science is crowding geography, or more properly physical geography, from its time-honored place in the first year of high-school work, and makes necessary a reconsideration of where geography shall be placed and what shall be taught. The recent development of the problem method of teaching—an old friend that the best teachers have long used unconsciously—is now becoming a rough tool for the beginner and the novice.

As a result, geography, which we believe has worth that can not be challenged, must be approached from a new standpoint. If the geographers do not help in this reorganization and redirection of geography, the task will be taken from our hands and chaos may result. A study of the literature of geography teaching shows that many educational leaders do not realize the significance or the beauties of the subject. They accept the table of contents of the formal texts on physical and commercial geography (of which nearly thirty different ones are now in use) as a digest of geography, not of special phases thereof, and either discard the subject as beyond redemption or accept it as something that must be endured. Few realize that there is any other geography than the physical and commercial geography of the last few years, though several reports advocating the development of regional geography, and the humanizing of physical geography, have been widely distributed and much discussed in recent years.

A study of the printed courses of study of 219 high schools from all parts of the country, of the answers to a series of questions received from 76 super-

2. *Journal of Geography*, Vol. VIII., No. 1, September, 1909, pp. 1-9.

3. *Journal of Geography*, Vol. VIII., No. 7, March, 1910, pp. 159-63.

intendents in large cities, of 24 replies to a similar questionnaire sent to a much larger number of high-school teachers—selected mainly by members of this association as the best and most successful teachers they knew—as well as 17 replies to a questionnaire sent recently to members of this association, shows emphatically that geography in high schools is in a rut and generally out of favor.

The printed announcements of 219 high schools, incomplete as they are as to details, indicate that geography is increasing in significance only in business or commercial courses. Excursions and field work are offered in but few schools, laboratory work is noted but rarely. The most favorable fact is that in more than half the schools giving geography, five hours a week are devoted to it, a fact more characteristic of business courses than of other courses. The dry facts as to the status of geography are sufficiently discouraging, but the detailed reasons for the facts, as given by teachers and superintendents, are even more so. We can draw many conclusions, according to our interests and points of view, as to why geography teaching is not more successful in secondary schools. We would all probably agree that geography in secondary schools suffers because it is not tied up with the earlier work and leads nowhere. Geography in schools lacks unity and purpose and hence strength. We as geographers have been putting our approval on a type of secondary-school geography in no way related to or based on the earlier school work. Students in the stress of secondary schools can have no working use of the details of their earlier work, unless those details are used in their regular work. When pupils have been exposed to no locational work for five or six years, certainly since they left the seventh grade of the elementary school, have college and normal school teachers a right to charge ignorance of location as the chief geographic weakness of high-school graduates? Have we been consistent or far sighted? When teachers are seemingly unaware, as their replies would indicate, that there is anything new in methods of geography teaching, or that they need pay attention to educational principles or movements, can we wonder that geography is not, to put it mildly, a universally sought elective?

We lament the poor teaching of geography in high schools and yet do not aid in its betterment either by showing how to get the real spirit of geography into the formal work, or by paying heed to the tendencies of educational thought. We can not play ostriches any longer and be self-satisfied in our exposed isolation. Neither can we rightly criticize geography teaching in secondary schools as being bad when in most high schools, outside of a few large cities, the geography work is not sufficient to demand the full time of an adequately trained teacher. Today, as shown by the replies received from questionnaires, and in the report⁴ of a study in the high schools of the middle west, the *special* teacher of geography is rare. Of fifty-eight teachers of geography in fifty-three high schools, eight taught geography only, and these were all in one school. The specially trained teacher of geography is even rarer. Of the fifty-eight teachers mentioned, only nine had had more than one year's work in geography in normal school or college. Usually the teacher of geography

teaches one or more other sciences, or some other subjects, perhaps physical training or stenography. The usual teacher of geography is a teacher of science or commercial subjects.

The lack of trained teachers of geography in the high schools is not due to lack of supply so much as to a lack of demand. An increased demand will bring a supply. We must put a new spirit and a new content into high-school geography. . . .

Meanwhile the old content of physical geography for secondary schools has persisted with but little change, or if we have included any phases of applied geography in our texts we have often done so in a forced or perhaps even apologetic way. In recent years some teachers and writers have made significant advances in humanizing physical geography, but so great is the inertia of the past that no one has as yet put forth any complete constructive program for the future high-school geography, which must be educationally sound, geographically strong and broad, and really worth studying for the usability of its content. It is in part due to the demand that geography shall be worth while that we owe the present tremendous significance of commercial geography, as yet not wholly devoid of its lists of "furs, feathers, gums and resins." . . .

Geography for secondary schools will in time be geography—and geography is not a synonym for physical geography or commercial geography. Geography is a human as much as it is an earth science. Its larger problems are human problems that involve a study not only of the influencing conditions of the physical environment, but of the economic and social conditions that may be as basic as the physical conditions. These larger problems are not wholly commercial or industrial. Commercial geography bears about the same relation to human geography that the physiography of the land or water does to physical geography. It is only a special phase of the larger subject, but a phase that can not be ignored in any complete study. . . .

The problem method of approach enables us to deal with the same basal content, so as to make a life-giving and thought-provoking subject. Further, this method will minimize the deadening influence of pure memory work which so long was considered the main phase of teaching. Facts and principles will be remembered because they are useful and because they are properly associated psychologically. "Discipline" will be secured through the efficient training of the enquiring mind in solving scientific problems, and the methods of work employed will make easier the study of other sciences approached in the same way.

This vitalized geography will be organized according to educational principles and will make use of the methods of teaching known to be best adapted to adolescence. Laboratory work, recitations, quizzes, or any other desirable plan will be brought in when most serviceable. The development of the individual and class will go hand in hand with the development of the subject

4. E. E. Ramsey, "Physical Geography in the High School," *School Science and Mathematics*, Vol. 11, 1911, pp. 838-48; Vol. 12, pp. 45-54; 114-25.

and not lag so far behind that it may be forgotten as a purpose in teaching. . . .

The new geography will lead pupils to appreciate the physical, economic and social causes underlying the consequences seen in human and life geography, so far as their age and powers will permit. This new geography will find its application in history, in economics and the other distributive subjects. Location will come back because the course will deal with facts and relations placed somewhere, and centering around some human group and its problems. Being a subject of value in the interpretation of human affairs, in making clear the story of the past as well as the conditions of the present, it will be used in other subjects. . . .

Any effective reorganization of high-school geography to meet "the situation that confronts us," the beginning of a revolution in geography teaching as epochal as that of the nineties—depends on many practical factors. We must have text-books in human and physical geography organized scientifically and better unified than many of the current books on commercial geography. As the new geography will involve the study not only of the distribution of people, but of the forms of life on which humanity depends, and will include a study of countries as well as people, we must have an adequate school atlas for America, similar to but yet different from those available in several countries abroad. We must have class-room guides involving the study of other geographic materials than text-books and atlases, and yet not wholly dependent upon topographic maps, agricultural bulletins and census reports, which are often mere makeshifts for the real thing. Finally we must have teachers of proper training, who have caught the spirit of geography and of modern education, and who want to teach youths geography and not merely some phase of geography to youths. The demand for teachers of this type, which already in fact exists, may involve our colleges and normal schools, few of which as yet pay much attention to geography.⁵ Perhaps the day will come when the paths blazed by a few colleges, and relatively fewer normals, in real geography teaching will be more generally followed and geography will come to its own in American education. The opportunity and demand are here, the responsibility confronts us. Self-preservation, and the increasing number of geographers who are winning their way to the front through their studies of life geography, would seem to suggest the lines of advance we should follow.

Geography can not be what it should if educational leaders, untrained in geography, are to direct its future course. Neither can a geographer develop his subject to its highest degree if he looks at it only from the window that has given him the most pleasing vistas of the science and pays no heed to the subject as a whole, or to the new conditions that modern educational science has brought about. Knowledge is becoming more and more specialized; progress is being made so fast in all sciences that the all-round naturalist, able to teach any science well, is almost an impossibility. Modern education is a science

5. "A Study of Geography in Normal Schools," *Teachers College Record*, March, 1914, pp. 1-12.

and an art. It is the necessary handmaid of all subjects that should enter into the training of youth. Let us then seek its aid. With our eyes turned ever toward the ideal, and yet recognizing that it is a practical problem before us, let us take such steps into the future as the best testimony of all interested, specially trained experts in the several cooperating sciences, warrants. Then geography, being proved of value and not merely taken on authority, will come into its own in all phases of education.

MINERAL RESOURCES OF THE UNITED STATES

The value of the mineral production of the United States now reaches \$2,500,000,000 a year. Though this value falls far below that of the country's farm products, the magnitude and scope of our mineral industry may be best measured by comparing our own mineral production with that of other countries, no one of which can compete with us in abundance or variety of mineral resources. The United States mines nearly 40 per cent of the world's output of coal, and produced 65 per cent of the petroleum in 1913. Of the more essential metals, 40 per cent of the world's output of iron is raised from American mines, and the smelters of the United States furnish the world with 55 per cent of its copper and at least 30 per cent of its lead and zinc. These are the raw materials on which has been founded a great metallurgical industry, but on which can be built much more extensive chemical and metal-working industries.

The only essential minerals of the first rank of which the United States has no known supply at all commensurate with its needs are nitrates, potash salts, tin, nickel and platinum, the list thus comprising two essential mineral fertilizers and three very useful metals. Probably no other nation in the world so nearly approaches absolute independence in respect to mineral resources.

In its reserve of mineral fuels, the United States holds an impregnable position as a world power in industry and commerce. Our production of coal overtops that of any other nation and, in fact, nearly equals the combined output of Great Britain and Germany, the nations that rank second and third.—[*Commercial America*.]

HALF A MILLION ACRES IRRIGATED FROM WELLS

The largest ground-water developments in late years have been those designed to provide water for irrigation; 500,000 acres are irrigated in the arid and semiarid States with well water, more than two-thirds of which is brought to the surface by pumping. Most of the irrigation with ground water is done in California. Moreover, irrigation with ground water is not confined to the arid regions; in 1909 more than 1,400 wells were pumped in Louisiana, Texas, and Arkansas for the irrigation of 110,000 acres of rice, and pumping plants for irrigating fruit and vegetables are installed in several localities in the East.

ECONOMIC GEOGRAPHY: ITS GROWTH AND POSSIBILITIES*

By R. H. Whitbeck
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REPORTS from nearly all parts of the country indicate a continued growth of commercial geography as a high school study. There are two evident reasons for this growth:

- (1) The increase of commercial courses, and
- (2) the trend toward practical and vocational studies.

Any branch of study which can prefix the word "commercial" to its name—commercial arithmetic, commercial English, commercial law,—promptly falls in a preferred class in the opinion of many people, particularly young men. In American education there is a persistent drift toward studies that promise to increase one's immediate earning power. Commercial geography is sharing in this movement. However, the study is not everywhere in high favor because, it is maintained,—

- (1) Its subject matter consists so largely of mere items of information loosely connected, ever changing, highly statistical, and possessing little scientific value.

- (2) The study appeals to the memory, does not require much, if any, independent reasoning, and hence does not develop intellectual power.

- (3) The supposed practical value is largely imaginary.

All of the objections resolve themselves into the assertion that commercial geography has little scientific value and that its supposed practical value is over-estimated. Nor is the assertion without some foundation. Those of us who are interested in making geography a really valuable branch of study must examine commercial geography in the light of these objections and decide whether they are genuine, and if so, whether they are inherent and irremediable.

Economic geography is not a science in the same sense that physics or chemistry is. Neither are history and economics, yet they are valuable instruments of education. It is not imperative that a study shall be strictly scientific in order that it may be valuable.

Economic geography is one of those studies which have a useful information content. The educated man is one with not only a *well trained* mind but also a *well informed* mind. Education is designed to give *both* knowledge and power. Some branches are valuable mainly because of their training value—ancient languages and geometry, for example. Others afford intellectual training, but are valuable mainly for the insight which they give into the wonderful perfection and order of Nature, e. g., physics, chemistry, and biology—the natural sciences. Still others record the achievements and the progress of mankind—e. g., history, and human geography. History as a

*Abridged from an address before the Commercial Teachers' section of the Iowa Teachers' Association, Des Moines, Nov. 4, 1915.

branch of study no longer has to be defended; it has made a place for itself because it furnishes a kind of knowledge which men wish to possess; it has deservedly come to occupy a large place in education. Few will condemn it merely because it appeals more to the memory than to the reason; it is not offered as a substitute for physics or geometry. Its purpose in education is to give breadth of mind, breadth of interest, breadth of outlook; to enable us to see events in perspective. The statesman, the publicist—the leader of men—who does not know history is a poor leader. No one defends the kind of history which merely enumerates dates, and battles, and dynasties; such was formerly presented under the name of history, but the subject had to grow out of that stage and it has done so. Now our best textbooks in history not only record the past, but they interpret it. They aim to show the causes and the consequences of great events as well as to narrate those events. School history has been rationalized; and because it has been, men concede that it is valuable, and willingly accord it a place in the scheme of education.

Economic geography must pass through—in fact, is passing through—precisely this evolution, and is gaining slowly in strength and rapidly in favor. In Europe it is almost, if not actually, the leading phase of geography in higher institutions.

A rational type of economic geography is, in my judgment, destined to be a part of the curriculum in all our high schools. If this is true, it is incumbent upon us to see that the study develops along sane lines. At once the question arises, What modifications in the study are needed to bring this about?

SOME CHANGES NEEDED IN THE SUBJECT-MATTER OF COMMERCIAL GEOGRAPHY

There is need of elimination; a smaller number of mere items should be taught. There is little value in enumerating a long list of the products of each country. It is not necessary to mention all of the crops of a country and to specify in what sections they are raised. Books of reference may properly contain such information, but not school textbooks. Each important country supplies to the world's trade certain things for which that country is more or less celebrated. People are interested in the fact that Germany has come to lead the world in the growing of sugar beets, and in the production of sugar, and that that small country raises more potatoes than even the United States, fifteen times as large. We are interested in Germany's great production of rye because it is the bread-stuff of the nation, yet we care little about the oats and barley. We promptly forget, if told, that "the high plains of the southwest are rich in meadows and raise fine cattle" or that "many hogs are fattened in the oak and beech forests of the South." The latter are details, scarcely more than incidents in the economic life of Germany. Knowing them does not give us insight into the causes of Germany's development or shed light upon the reason for the phenomenal growth of the nation's industries. We are ready to learn facts that are significant, but we don't care for mere lumber.

Geography is the only study in the schools in which young people can get systematic knowledge about the nations and peoples that make the modern world. And though we may call our study *economic or commercial*, what we really want is a broad-gauge type of geography. We desire to have some idea of the relative size of countries because size counts in certain important ways. We want to know their resources, the strength and weakness of their geographical position, the invigorating or enervating quality of their climate, their food-producing ability, their degree of dependence upon others for raw products or supplies of any kind, their transport facilities, their military and naval strength, the character of their government, the efficiency of their educational systems, the race fiber of their people, and the things which they can do in a superior manner. We want to understand, if possible, the real character of the country and the genius of its people. This sort of geography gives both insight and outlook; it trains for citizenship and for leadership. It cooperates with history, literature, and science in making the man of breadth. Geography of this character will never be called upon to defend its right to a place in the schools. That right will be conceded.

Such a conception of geography calls for the classification of countries into about three groups, according to their respective importance in the world's affairs.

- 1—Countries of the first order
- 2—Countries of the second order
- 3—Countries of lower orders

The first group includes Great Britain, France, Germany, Russia, and the United States. The second group includes Austria-Hungary, Japan, China, Italy and possibly Holland, Belgium, Argentina, and Brazil. The third group includes the rest. This is simply my own classification and doubtless would not be acceptable to all.

The countries of the first and second groups are the ones that loom large in the world's affairs; the countries that are doing things in a big way. In the third group are also some highly interesting countries—Switzerland, the Scandinavian countries, Mexico, and Chile. If we make school geography effective in giving insight into the character of the leading nations, we must select the important countries and spend time upon them. In case only a half year is allotted to geography, it would be possible to dispose of the minor countries as outside reading or to study them very briefly.

I am persuaded that the improvement of economic geography lies, in part at least, in studying a smaller number of countries, in eliminating a host of disconnected items of general information, and in centering attention upon those factors in the geography and life of the nation which really make it what it is. Some of those factors will be strictly geographical and some will not be, but the latter are so closely interwoven with geography that they can not well be separated from it.

There are geographers—and good ones—who hold that economic geography should be largely a study of commodities and the circumstances of their production and distribution. I can not bring myself into accord with this view. This may answer for strict *commercial* geography, but I believe there is a broader and better kind of geography than this. I cannot escape the conviction that in the study of geography the unit should be the *country* rather than the *commodity*—such as wheat, corn, or iron. If time can be made for treatment from both angles, so much the better.

Following these general principles may I descend to some particulars regarding methods of procedure?

(1) *Geography should always involve a knowledge of location, and knowledge of location is gained by working with maps.* Three types of maps are needed:

- 1.—Good, clear maps in the textbook itself, with an atlas near at hand.
- 2.—Progressive outline maps for pupils' use. These are inexpensive.
- 3.—Wall maps, showing the main physical features and political divisions of the continents.

There should be a reasonable amount of map-sketching and a little careful map-drawing. One of the best of tests for clear ideas of locational geography is the ability to sketch, in a few strokes, the outlines of a country or continent, and to place in their correct positions a few of the most important natural features, political boundaries, and cities.

For the sake of definiteness, each teacher should have a thoughtfully-made minimum list of cities, rivers, arms of the sea, etc., and see to it that these are thoroughly taught and occasionally reviewed. Taking Europe as an example, there are about ten cities of great international importance:

Group I. London, Paris, Berlin, Vienna, Rome, Petrograd, Constantinople, Antwerp, Hamburg, Liverpool. Each of these is worthy of study, including the exact location, advantages of location, approximate size, most important activities, and any special matters of real significance.

There are about 20 or 25 cities belonging to a second group.

Group II. Manchester, Birmingham, Glasgow, Marseilles, Genoa, Venice, Naples, Athens, Brussels, Rotterdam, Amsterdam, Copenhagen, Stockholm, Christiania, Moscow, Madrid, Lisbon, Edinburgh, Milan, Lyons, Budapest, Dublin, Essen, The Hague, Warsaw (25). These are cities of large commercial, industrial, or political interest; cities that appear constantly in current news and comment, and about which the high school student should know at least one or two main facts besides that of location.

In addition, there are other cities whose names are so often seen and heard that educated people desire to know at least *in what country* they are.

I am listing 50 such cities; perhaps the list is too long.

Group III.

Barcelona	Cologne	Kiev	Prague
Basel	Cork	Konigsberg	Portsmouth
Belfast	Danzig	Leeds	Riga
Belgrade	Dresden	Leipzig	Seville
Bergen	Dundee	Liege	Sheffield
Bordeaux	Florence	Lille	Stettin
Bradford	Frankfurt	Lodz	Strassburg
Bremen	Geneva	Munich	Stuttgart
Breslau	Ghent	Newcastle	Trieste
Bristol	Hammerfest	Nuremberg	Turin
Bucharest	Hanover	Odessa	Zurich
Cadiz	Havre	Oporto	
Chemnitz	Hull	Palermo	

The following rivers and coastal waters are worthy of attention: *

Clyde to Glasgow (ship-building)

Mercy to Liverpool—canal to Manchester

Tyne to Newcastle (ship-building)

Thames to London

Seine to Paris

Scheld to Antwerp

Garonne to Bordeaux

Rhine, Elbe, Weser, Oder, Vistula, Danube, Volga.

North Sea, English Channel, Strait of Dover, Irish Sea, Baltic Sea, Bay of Biscay, Mediterranean Sea, Adriatic Sea, Aegean Sea, Black Sea, Dardanelles, Bosphorus, Caspian Sea, Strait of Gibraltar.

Optional: Rhone, Severn, Loire, Tagus, Po, Tiber, Don, Dnieper, Gulf of Finland, Gulf of Bothnia, Zuyder Zee, Skager Rack, Cattegat, White Sea, Sea of Marmora, Sea of Azov.

(2) *A good course in geography teaches the pupils the habitual use of standard reference books; the encyclopedia, the Statistical Abstract of the United States, the Statesman's Year Book, the Year Book of the Department of Agriculture, the annual volumes of the U. S. Geological Survey on the Mineral Resources of the United States, the abstract of the U. S. Census and even the World Almanac. Every state issues reports and bulletins of geographical value. It takes a little writing to find out about these, but it pays. Cities, railroad companies, steamship companies, manufacturing companies, and many others issue illustrated booklets.* Literature, designed mainly for advertising purposes, is to be used sparingly but it is sometimes useful, mainly because of excellent illustrations.*

*The Journal of Geography published a list of 500 such in January, 1915, and copies of the issue of the magazine are still available (15c).

(3) *A good course in geography gives training in looking-up material and in organizing and presenting special topics.* The experience and training gained in doing such work is often worth more than the knowledge. Such topics may involve either the intensive study of some country or of some subject, of which the following are examples:

The coffee industry of Brazil
The nitrate industry of Chile
The cacao industry of Ecuador
The sugar industry of Cuba
The silk industries of Japan
History of the Panama Canal
History of the Suez Canal
Agriculture in China
Grazing in Australia
The gold and diamond mines of South Africa
Lumbering in Washington
Iron mining in Minnesota
Cotton growing and marketing
The seal fisheries of Alaska
The salmon fisheries of the Pacific Coast
The Trans-Siberian Railroad

Debating is one of the finest of intellectual exercises and one in which many students take a great interest. Certain questions in geography lend themselves to this sort of discussion; classes profit by such debates between selected teams of three or four persons on a side. The following questions are illustrations:

1. *Resolved:* that for foreign trade the geographical situation of Germany is superior to that of France.

2. *Resolved:* that the building of the Panama Canal will benefit world-trade as much as did the building of the Suez Canal.

3. *Resolved:* that free trade should exist between the United States and Canada.

4. *Resolved:* that the U. S. Congress would be justified in appropriating during the next ten years a sum up to \$400,000,000 for the improvement of rivers.

5. *Resolved:* that the United States is in need of a greatly enlarged merchant marine and should take any steps necessary to secure it.

(4) *The local industries, the trade between the city and the surrounding country, the home city's advantages of location, its railway connections, and the probable reasons for the city's growth or lack of growth are profitable topics for study and discussion.* If time permits, the study of the resources and industries of the home State is well worth while.

(5) *The exercise known as "scoring" a country on its points of advantage for carrying on industries and commerce is a thought-stimulating device.*

This consists in assigning a numerical value to each of the most important points that determine a country's rank industrially and commercially. The following assignment of points has been tried and found satisfactory:

A nation which is ideally endowed in all particulars for purposes of commerce and industry is assumed to be entitled to a perfect score, 1000. No such nation exists. The United States would perhaps deserve the highest score, though not 1000; possibly 900 to 950.

Each of four important points is weighted as follows:

1. Climate in all its bearings, combined with area, 250 points.
2. Natural resources, their extent, variety, availability, distribution, etc., 250 points.
3. Natural advantages for carrying on international commerce, including physiography, boundaries, coast lines, situation with respect to other commercial nations, 150 points.
4. The people and the intelligence with which they utilize their advantages and resources, 350 points.

The country which is under consideration is to be given such a score on each of the four points as the students, after careful thought, believe it entitled to. The sum of the four separate numbers gives the total score. The student must be prepared to explain and defend his scoring in every instance.

The value of such an exercise is considerable; it induces students to weigh the various factors which determine a country's ability to hold a place in the commercial world; it leads to a thoughtful comparison, point by point, of one country with another; it brings out the difference between a country that lives up to its possibilities and one that fails to do so; and the quantitative nature of the result secures definiteness. As a means of testing a student's actual understanding of a country, the device is excellent. Of course no two persons, however competent, would give a country exactly the same score. A margin of at least 100 points in the total may be allowed for differences in judgment between equally competent persons.

Conclusion.—As has already been pointed out, the trend of the times forecasts the widespread adoption of economic geography in the high schools. The trend is merely part of a large movement toward socializing the curriculum and toward vocational or semi-vocational studies. Economic geography sanely organized and purposefully taught gives breadth of outlook and breadth of interest; it yields a kind of knowledge which educated people desire to possess and it can be so taught as to furnish training of high value. To see that these worthy ends are, so far as possible, realized in practice is the duty of the geographers and geography teachers.

GEOGRAPHY IN THE JUNIOR HIGH SCHOOL—ITS RELATION TO ELEMENTARY SCHOOL AND TO SENIOR HIGH SCHOOL GEOGRAPHY

By Clara B. Kirchwey
Teachers College, New York

THE organization of the Junior High School is a matter of peculiar interest to the teacher of geography and to many others outside of the profession who, from their knowledge of the field of geography and from a realization of its place in the understanding of present day problems, appreciate its importance in the school curriculum.

PRESENT CONDITIONS

Geography has never come into its own in this country. Why it is regarded as a subject which should practically be limited to the grammar school passes the comprehension of those who know both something of the subject, and something of the capacity of pupils under secondary school age. Our failure to teach geography in the grammar school is so patent and arouses such general condemnation that it would seem unnecessary to call attention to the fact here were it not that the diagnosis of the disease is usually so wide of the mark.

"Why do not our boys and girls know something of geography when they reach college?" the college instructor demands. Their ignorance is so colossal that there is nothing to build upon even where fundamentals only are required. No one would be so unreasonable as to look for any refinements of knowledge in this subject. Many have undoubtedly had experiences with college students as illuminating as was the query of one such student who propounded the following: "Is Omaha a city or a state? It sounds like a state." She was an exceptionally intelligent girl and had had the usual elementary school training in geography. It is needless to say, however, that she did not know geography when she reached college.

Many of our high school graduates go not to college but to the normal school. The period for training here is short, the field necessarily broad, and the time allotment for each subject, therefore, is limited. If the student has had the training to prepare himself to take up his professional work the task of the normal school is not impossible. Has he had this training? Can his instructors pass on to him the best thought and the experience of the ablest teachers as to ways and means of presenting subjects? Certainly not as far as geography is concerned, for the normal student does not know enough of the subject to be a candidate for methods of teaching it.

The boy or girl who goes into business life after leaving the secondary school suffers from the same lack of equipment. The particular line of work entered upon may or may not call directly for this knowledge but intelligent every day living does demand it. A little more of this knowledge than most of us possess would do much toward straightening out the intellectual tangle of persons, places and events from which a majority of us suffer chronically, often without a realization of our hopeless state. Occasionally, however, this condition is brought home to some of us. This occurred recently when several college classes were tested on conspicuous facts in connection with the present great war and were found to be sadly wanting.

REASONS FOR PRESENT CONDITIONS

The reason for this general lack of geographical knowledge in the college, in the normal school, in the business world, or in any other station is not far to seek and cannot fairly be attributed to poor teaching—the explanation generally offered and accepted. What knowledge of history, of mathematics, of English would our boys and girls possess upon reaching college if these subjects were abandoned in the seventh grade of the elementary school? We depend upon the secondary years to implant that body of knowledge in these subjects which is to be carried over into college or into other lines of activity. Why should we expect any other course to be successful in the case of geography? A period of five years, from the end of the seventh year in the grammar school to graduation from the high school, is a long stretch in the life of boys and girls. We certainly cannot hope that the geography that they studied mainly as little children in the intermediate years of the elementary school will bridge the gap—and this, not only because the interval is too long to make the expectation a reasonable one but because the subject, excepting the very rudiments of it, is too big a one for little minds to grasp.

GEOGRAPHY IN THE JUNIOR HIGH SCHOOL

The day must come when geography will be recognized as a secondary school subject as history is today, and it is to the Junior High School that we must look for pioneer work in this reform. The established secondary school has so persistently clung to the traditions of education handed down from mediaeval times, secondarily as a result of demands on the part of the college but primarily as a result of its own inertia in accepting these demands, that little can be expected in the opening of new fields here. Any attempt of this kind is met with the slogan of the college preparatory school—"More time for Latin and mathematics!"

The Junior High School has the great advantage of being so very recent that no traditions can bind it and here we may confidently expect a careful consideration of the claims of a subject for admission. In putting forward the claims of geography it should be understood that our plea is for a comprehensive study of countries, or what is so well named "Regional Geography."

IMPORTANCE OF REGIONAL GEOGRAPHY

It may be said that many of our secondary schools offer geography, and it is true that an opportunity is frequently given for a year's work either in physical or in commercial geography. To the uninitiated this may seem at least a partial meeting of the situation but the teacher of geography knows only too well that these subjects can never act as substitutes for the study of countries—the work that is attempted in the elementary school. Physical geography, embracing some work in mathematical geography, meteorology, dynamical geology, and oceanography is undoubtedly a valuable subject, but no amount of attention to "life responses" can transform this into a comprehensive knowledge of regions, a more valuable study as far as fitting our boys and girls for life, rather than for the college entrance examination, is concerned.

Commercial geography, to be of value, must renounce its time honored method of instruction. It is gradually coming to be recognized that the subject is something more than a compilation of names of products, imports, exports and statistics of amounts that are forgotten as soon as acquired. Facts are no longer pursued as an end in themselves but as a means toward the end of interpretation and of application to the great game that is carried on between sections of our own country and beyond our borders. Commercial geography is regarded by geographers as the culmination of the science. It is frequently graphically shown as the apex of the pyramid whose solid foundation is laid in the unchanging facts of mathematical geography. The summit is gained only through a conquering of the intermediate stretches. Regional geography, rightly viewed, forms the great body of the pyramid.

The need for this regional study is recognized by our commercial geographers as the following quotation from a well known text book indicates: " . . . the intensive regional study of the world, or of some considerable part of it, logically precedes and forms the training for the broader and more complex generalizations involved in the study of the great world industries."

The elementary school can only make a beginning as far as "intensive regional study" is concerned. Fourth and fifth grade children are not ready for it. The sixth grade pupils are scarcely mature enough though we look to them for a beginning in work of this character. Will the Junior High School carry it on and defer the study of commercial geography until a real foundation for it has been laid?

While there is reason for strong hope that the Junior High School may aid materially in the development of geography in our schools, it carries, on the other hand, an element of danger with it. In view of the tendency to divide the twelve year course of the combined elementary and high schools into a six year period for each of these stages there is more than a possibility that

*Robinson's *Commercial Geography*—Rand, McNally & Co.

an attempt will be made to crowd the work that has ordinarily been carried through the present elementary school with its seven grades, or through seven grades of an eight year school, into the new six year school. It is unnecessary to say that while the state of geography is bad it might be even worse and surely no argument is needed to prove that, in the case of a subject already cramped by the measure of time allotted to it, a year saved would be anything but a year gained.

It is encouraging to learn that, in a few schools where the Junior High School has been established, two years are given to the study of "Common School Geography." This may be a survival of the old eight grade curriculum rather than the beginning of a movement to push geography on into the high school but, whatever the cause of its appearance, let us welcome the fact, and hope that this day of small beginnings may be the augury of better things to come.

CONCLUSION

It seems now a Utopian dream to think of regional geography carried as a matter of course through the Junior High School and made preparatory to advanced courses, possibly commercial in character, in the Senior High School. That this will some day come to pass, that geography will rank in importance with its sister science, history, and that a knowledge of geography will be considered as essential in our country as it is in Germany and in Great Britain today, seems inevitable to those who know its scope and who realize its possibilities in the interpretation of life.

WORK TO BE DONE BY THE NATIONAL COUNCIL OF GEOGRAPHY TEACHERS

1. State-wide cooperation in establishing a vigorous State Council and in securing energetic officers, full of enthusiasm. No movement gets far without enthusiasm.
2. Division of the states into districts with leaders who are made responsible for getting certain things done in their respective districts: for example, (a) seeing that geography is represented on the programs of the district and local teachers' associations; (b) aiding in securing geographical articles for educational papers in their states; (c) encouraging the formation (among teachers) of geographical reading clubs and study clubs, with an occasional lecture by an outside man.
3. Cooperation with the officers of the State Teachers Association in placing upon the annual program a strong and effective speaker on some geographical subject. Several state councils are now at work on this for next fall's meetings.
4. The formation of geographical societies in centers where there is prospect of sufficient interest to warrant it.

LOST OPPORTUNITIES IN TEACHING GEOGRAPHY

By Zonia Baber

School of Education, University of Chicago

IN these sad times of international brigandage and murder the failure of our ethical teaching in the church, in the home, and in the school strikes us like a freezing blast. How forcibly it makes us see the paramount need of society! And it is in the needs of society and in the needs of the student that the standard is found for evaluating the subjects in the school curriculum. Hence this deplorable situation is of preeminent concern for teachers. How can the school meet this need? By carefully examining each subject taught, as well as the method of teaching, the solution of this difficult problem may be found.

Political Geography never meant so much to the entire world as it means today. Neighbors living amicably on either side of an imaginary line, known as a political boundary, are surprised to find themselves enemies, although ignorant of the cause that has transformed their relations. This imaginary line determines that one may be legitimately fired upon or drafted into the killing of others, according to the rules of war, while the other remains peaceably at home. A map of the world showing all the land that may be legitimately attacked is a saddening picture. It is doubtful if the people of the various nations since their tribal days have felt *nationalism* so deeply as now. This national atavism has occasioned most profound regret on the part of all who hold high ideals for humanity. For it cannot be denied that *internationalism* has had a severe shock. However, this *ideal* of internationalism must be realized if society is to avoid constant reversions to barbarism. "The present situation presents the spectacle of the breakdown of the whole philosophy of nationalism, political, racial, and cultural."* The world is stunned and is crying for permanent peace. Yet, "It is futile to work for the negative end of peace unless we are committed to the positive ideal which it cloaks: promoting the efficacy of human intercourse irrespective of class, racial, geographical and national limits."*

So long as the European or White Race retains its childish or primitive belief, that it is superior to all other peoples and consequently intended by God to dominate other races there can be no hope of a permanent peace. This conviction of superiority belongs to the white man's list of fundamental beliefs. Among these is the belief in gravity, the rotation of the earth, and the immortality of the soul. To question these faiths would be sacrilege. He boasts of the accomplishments of his race just as he rejoices in the beauty of an autumn day. To him it is the statement of a truth which he supposes all appreciate, and it is at the same time an expression of his delight in this truth.

*Dewey: *German Philosophy and Politics*.

This exalted self appreciation is not an attribute of the white or European people alone. A traveller, recently returned from Africa, where he had gone to study the language of the Congo people, reported that he had found the same belief in race superiority among that people. They are confident that they are the greatest people in the world. As evidence of the white man's inferiority they cited his inability to walk, as he had to be carried in a hammock; and his inability to find his way in the forest. "If you are superior to the white man how is it that eight hundred Belgians can govern a million of you Africans?" asked the American. "Because they have guns," replied the African. "Does not the fact that they can make guns prove their superiority?" continued the white man. "Did you ever make a gun?" asked the African. "No, but I could learn," said the American. "So could I," returned the African, and he spoke the truth as the Congoese who have gone to Paris and Brussels have readily learned to work in the various European industries.

Each individual and nation is evaluated according to the ability or skill shown in doing the thing the evaluator or judge does best. The people who do not play the game of life as we are playing it are forsooth inferior to us. For if they try to play our game we can beat them of course with our knowledge of its intricacies. "In short, historical events appear to have been much more potent in leading races to civilization than their faculty, and it follows that achievement of races does not warrant us in assuming that one race is more highly gifted than the other."* The early missionaries reported that the people of the Fiji Islands were largely governed in their domestic customs by their belief in witches. They believed that if an unfriendly person found hair, finger nail trimmings, food, pieces of clothing, or excreta of another, the finder could bewitch the owner by hiding the object in the thatch of the roof of his dwelling or by concealing it nearby. In a short time the owner would become ill. This belief in witchcraft resulted in great cleanliness in all the villages, as everything discarded was buried or burnt. The missionaries taught them that there were no witches; hence the need of strict cleanliness was removed and disease resulted. These new teachers destroyed a valuable hygienic belief without giving a substitute. Pragmatically considered the Fijian witchcraft had the same value as the present day germ theory. In spite of the fact that every race egotistically believes in its own superiority, it is doubtful if there is or ever was a race of marked superiority. However there are individuals of superior mental ability and others of inferior intellectuality in every division of the human race. This is the fact that should be kept in mind in the study of every people. For, "History teaches us that there can be no middle course. Either race antipathy and race contempt must disappear or one breed of men must dominate the other.

"The psychology of race contempt has never been dispassionately studied. It is felt most strongly in the United States and the West Indies, a little less

*Boas, Franz: *The Mind of Primitive Man*.

strongly in the British Tropical Colonies. . . . It is moreover a sentiment of modern growth. In the fifteenth and sixteenth centuries Englishmen did not regard colored people as their inferiors by reason of the color of their skin. It appears, in fact, to date only from the time of slavery in the West Indian Colonies. . . . If this race contempt were a primitive instinct with the white race the future of mankind would be lurid indeed, for it is impossible to believe that one half of humanity can be kept forever inferior to the other without deluging the world in blood."*

It is difficult to understand how the "White Race" can ignore the reports given by the European teachers in the southern hemisphere. Every one questioned by the writer last year said, "Intellectually there is no difference between the white children and the blacks of Australia, the Polynesians, the Micronesians, the Japanese, Chinese, Portuguese, and various mixtures found in the islands of the South Seas."

The fact that other people believe themselves the "chosen ones of God" and act upon this belief, in no way atones for our sin in this direction. We shall be held responsible for our acts, and unless the belief in the brotherhood of man becomes a conviction instead of a platitude, race war is inevitable. Race prejudice must be eliminated in order to avoid this awful calamity. In perplexity we turn to the school for help. Here we find that the Geography teacher more than any other has the opportunity of erasing race prejudices. This is because Geography is the only subject that brings one into contact with all the living peoples of the world.

The geographer's greater opportunity brings with it greater responsibility. In order that the student may learn to emphasize the best natural qualities of others as readily as he is wont to emphasize those of his own people, care must be taken to stress the greatest achievements and best characteristics of all foreign peoples studied. For, we are prone to measure others by their worst attributes. "A man must not do reverence to his own sect by disparaging that of another man," said the great Emperor of India, Asoka, in the third century A. D. No better standard for testing human relations has ever been found than the Golden Rule. This test should constantly be applied to all geographic facts where human relations are concerned. This will tend to establish an intellectual habit of justice, which is the only true basis of amity. We have expressed the highest patriotism when we can say, "The country *right* is my country," whether it be located in Europe, Asia, Africa, Australia, or the Americas. Shall we ever find national righteousness in a lesser patriotism? Since Geography by reason of its content is so largely responsible for our attitude towards other peoples, it follows that much of the subject matter should be rewritten as it too often reflects the nationalistic point of view. The geographers have expressed what the anthropologists have taught until recently. But a great change has come in anthropological thinking. Notwithstanding

*Thompson, Basil: *Fiji and the Fijians*.

the fact that the greatest teachers have preached the brotherhood of man for two thousand five hundred years or more the pleasing fallacy that "we are *the people*" is still believed by each section of the human family.

Since Geography offers so great an opportunity for giving the ethical point of view it follows that some aspect of the subject should be taught in each year of school and college. When this is done by teachers who have the geographic or human point of view, internationalism will be realized.

AN EXAMINATION IN ELEMENTARY GEOGRAPHY

By Lawrence Martin
University of Wisconsin

THE following examination was given to 92 of the members of a class of university students, largely freshmen, at the beginning of their course in college geography. It is based upon their grammar school geography and upon what they might have learned subsequently from courses in history and other high school subjects, from work in the first half year of college, and from reading the newspapers. The students had had no review whatever of any topic represented in the examination, except that of standard time. The purpose of the examination was informational, for instructor and students alike. The results do not enter into the term grade.

1. Write the names of all the countries in Europe (Column); Of the capitals of what you regard as the 6 great powers.

2. Name the four great rivers of Africa. Tell where each is.

3. What would you call the *one* principal mineral or vegetable product of (a) Brazil, (b) South Africa, (c) United States, (d) Wisconsin, (e) Cuba?

4. What is the general type of weather now in New Zealand?

5. What country controls (a) the Philippines, (b) Newfoundland, (c) Bermuda, (d) Iceland, (e) Panama, (f) Hongkong, (g) Suez Canal, (h) Sicily, (i) Niagara Falls, (j) Korea?

6. It is 9:30 at Madison—what time is it at (a) Washington, D. C., (b) New Orleans, (c) London?

7. What language is spoken in (a) Brazil, (b) Switzerland, (c) Australia, (d) Province of Quebec, (e) Nicaragua?

8. Through what states does the main line of the Northern Pacific Railway pass? The Pennsylvania Railway?

9. In what latitude is (a) the Arctic Circle, (b) The Tropic of Capricorn, (c) the North Pole, (d) The equator, (e) Madison? In what longitude are (f) Greenwich, (g) Madison, (h) the International Date Line, (i)

the South Pole, (j) a point in Asia half way from Greenwich to the International Date Line?

10. Locate the following places (state or country) and mention what historical or other events you associate with each:

- | | |
|-------------------|-----------------------------|
| (a) Dardanelles, | (f) Jerusalem, |
| (b) Vinland, | (g) Appomattox Court House, |
| (c) Valley Forge, | (h) Marne, |
| (d) Poland, | (i) Vera Cruz, |
| (e) Rubicon, | (j) Mecca. |

In this examination 81 out of the 92 students, or 88 per cent of the class failed to receive a passing grade of 70. The questions were then given to two other groups of students (a) those in the university course on the teaching of physical geography and (b) two divisions of the physical geography class in the Madison High School. The members of the teachers course are mostly seniors. Many of them have had other courses in physical and applied geography. They are especially interested in the subject and intend teaching it. During the first semester of the present year they had had a review of a few of the topics represented in the examination, especially those in mathematical geography. Accordingly only 11 out of the 20 students or 52 per cent failed to pass the examination. The high school class, second-year students, had likewise reviewed a few of the topics represented in the examination. More important, they had forgotten less of their grammar school geography, because of having studied it only three years before. Twenty-nine out of 51 students, nearly 57 per cent, failed to pass the examination.

The following table summarizes the marks received by these three groups of students. The three-year intervals between these groups, the growing maturity of mind, and the fading away of grammar school geography with disuse are all reflected in the results of the examination. It would be interesting to give the same questions (a) to a grammar school class in geography, (b) to a group of mature men who are not teachers of geography.

Grade per cent	College Seniors 21 students		College Freshmen 92 students		High School Soph- omores, 51 students	
	Number	Percentage	Number	Percentage	Number	Percentage
91-100	2	10	1	1	2	2
81-90	3	14	3	3	1	2
71-80	5	24	7	7	19	37
61-70	2	10	18	19½	11	21
51-60	3	14	21	23	3	6
41-50	4	19	19	20½	7	13
31-40	2	10	16	17½	2	4
21-30			6	6	5	10
11-20			1	1	1	2
Highest grade.	(.96)		(.92)		(.96)	
Lowest grade..	(.33)		(.18)		(.15)	
Number below .70.....	11	52%	81	88%	29	57%

CURRENT GEOGRAPHICAL MATERIAL

GREAT SALT LAKE

Great Salt Lake, in the northwestern part of Utah, is about 75 miles long with a maximum width of 50 miles, and covers an area which will average about 1,750 square miles. Mr. G. K. Gilbert, of the United States Geological Survey, writes:

"Great Salt Lake has no outlet. Jordan River, which enters it from the south, is the outlet of Utah Lake. Bear River, coming from the north, carries the outflow from Bear Lake. The waters of Utah and Bear Lakes and of Jordan and Bear Rivers are fresh, and so is the water of Weber River, the third great tributary of Great Salt Lake, but the lake into which the three rivers flow is saline. It is saline because it has no outlet. The fresh waters of the rivers contain some saline matter, but the quantity is too small to be discovered by taste, but when account is taken of the total volume of water brought by the streams to the lake in a year their burden of saline matter is found to be really great, amounting annually to more than 500,000 tons. They have accumulated until the lake water is approximately saturated, holding nearly as much mineral matter as it can retain in solution. The lake contains over 5,000,000,000 tons of common salt and 900,000,000 tons of Glauber's salt (sodium sulphate) as well as other mineral matter."

To give a concrete illustration of the significance of this amount of salt it may be stated that the United States, the greatest salt-producing country in the world, produces annually about 4,800,000 tons and imports something over 1,300,000 tons. Deducting the amount exported, the annual consumption of common salt may be placed approximately at 6,000,000 tons. Should every other source be eliminated, there is enough salt held in solution in the waters of great Salt Lake to supply the United States, at the present rate of consumption, for nearly 1,000 years to come.

The variation in the superficial area of the lake is explained by Mr. Gilbert as follows:

"Another consequence of the lack of outlet is that the lake varies from time to time in size. Whenever the gain from inflow is greater than the loss from evaporation the level of the water surface rises; when the loss is greater it falls. In a series of wet years the lake level progressively rises; in a series of dry years it progressively falls; and as the rainfall is irregular the fluctuations of the lake are conspicuous. Since definite knowledge of the lake began, in 1850, there have been five periods of increase and four of decrease. The summer levels of 1868 and 1877 were more than 10 feet above the summer level of 1850, and those of 1903 and 1905 were 4 feet below that of 1850. The level of 1914 was 6 feet above that of 1905."

The land bordering the lake has a gentle slope, and a small change in the height of the water makes a great change in the area covered. A rise of 10

feet enlarges the area about 24 per cent. During the Glacial Period the rate of evaporation was far slower than now, and as a result there was an immense expansion of the water surface. When the lake was largest it had eleven times its present extent. The only permanent animal inhabitant of the waters of Great Salt Lake is a very small "brine shrimp," about one-third of an inch in length. Industrially the lake is used for the production of salt. The water is drawn off into shallow ponds, where it is evaporated by the heat of the sun. The present annual output is only about 40,000 tons, and the gathering of this quantity of salt seems to have no appreciable effect on the salinity of the lake. Mr. Gilbert states that this output could be multiplied fivefold before it would even commence to weaken the brine.—[*Abridged from Pan-American Bulletin.*]

THE NAVAL STORES INDUSTRY

The manufacture of turpentine and rosin is generally conducted on what is called a "turpentine farm." The farm consists principally of a tract of timber land, in many cases leased by the operator for the turpentine privileges. The equipment of a farm, exclusive of land or leases, costs from \$5,000 up, the average value being about \$10,000.

There are two chief systems of extracting gum from the trees, called, respectively, the box system and the cup system. The first step in the gathering of the gum by the box system is the cutting of a box or cavity into the base of the tree by means of an axe, to receive the liquid gum which is called dip. This operation is followed by chipping, which is the wounding or scaring of the trunk of the tree directly above the box. Chipping begins in March and April and continues at regular intervals for about thirty-two weeks. In flowing to the box a certain proportion of the crude resin coagulates on the face of the tree. This residue, which is called scrape, is allowed to form undisturbed until toward the end of the season, when the flow of the gum has practically ceased. It is then scraped off and transferred to the still.

In the cup system of gathering the gum, a clay or metal cup is substituted for the box cut into the tree itself. The chipping of the tree begins above the location of the cup and continues upward in the same manner as when the box is used. The gathering of the crude gum is followed by its distillation. The still is a large copper kettle, provided with a movable goose-neck cap. Beneath the copper still is a grate which is large enough to accommodate four-foot wood. In a "charge," which requires from three to five hours for its distillation, the still usually contains from five to eight barrels of dip or scrape. As the still is heated and the vapors pass off, water is added to facilitate the evaporation of the spirits of turpentine and to prevent burning. The spirits of turpentine is then transferred into tight white-oak barrels or casks of about 50 gallons capacity, and is ready for shipment.

The residue in the kettle after the turpentine has been distilled off is rosin, which, while molten, is drawn from a tap. The rosin while hot is

ladled from the vat into rough pine barrels in which it is marketed. These are termed round barrels and weigh approximately 510 pounds gross. Every barrel of spirits of turpentine or rosin is carefully examined, the weight and grade of its contents are branded upon the barrel, and sworn certificates as to the contents are made and furnished to the factor. The manufacture of naval stores is one of the oldest industries of the United States. The primitive method of charring wood under sod in kilns or pits to extract tar and pitch was employed by the earlier settlers of the eastern coast of Virginia and the Carolinas. Because the use of tar and pitch at this period was practically restricted to shipbuilding they were called "naval stores," by which term they, as well as spirits of turpentine and rosin, are still known.

As early as 1762 tar, pitch, turpentine and rosin were exported to the United Kingdom from North and South Carolina. In 1849 the industry was largely confined to the eastern part of North Carolina, but it has gradually extended southward and westward, following the course of the long-leaf-pine belt, until it covers the States of North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana and Texas.

The value of the production in the United States in 1909 was \$25,295,000, of which \$12,654,000 was the value of the turpentine, and \$12,576,000 the value of the rosin. A comparison of the census figures for the preceding decades shows there has been an enormous increase in the later periods.

The United States is the chief source of supply of turpentine and rosin for the whole world, furnishing two-thirds of the turpentine and three-fourths of the rosin. It likewise sets the world prices of these products. For more than a quarter of a century this has been one of the duties of the Savannah Board of Trade, successor to the old Naval Stores Exchange. Prices on spirits of turpentine and all grades of rosin are made twice each day by this board, at 11 a. m. and 4 p. m., respectively. While the average man realizes in a vague way the importance of Savannah as a naval-stores market, few outside of the trade know that the Savannah Board of Trade sets the prices for the world.—[Abridged from *Commercial America*.]

AGRICULTURAL AMERICA

The great attention that has been paid by writers in general to the increase of the output of the manufacturing industries of the United States and to the steady growth of the exports of the manufactured products has led many to lose sight of the fact that the United States is the greatest agricultural nation in the world. Its grain fields cover 222,226,000 acres, an area greater than the whole of Germany and the United Kingdom combined. The corn and wheat fields alone cover 168,219,000 acres, or 13,440,000 acres more than Austria-Hungary, which is the largest country in Europe outside of Russia. Seventy-five per cent of all the corn, 62 per cent of the cotton, 35 per cent of the tobacco, 27 per cent of the oats and 26 per cent of the wheat of the world are raised in the United States.

The following table is from a report recently issued by the United States Department of Agriculture:

	Total production Bushels	Total farm value
Corn:		
1915	3,054,535,000	\$1,755,859,000
1914	2,672,804,000	1,722,070,000
Average 1909-1913	2,708,334,000	1,527,969,000
Winter wheat:		
1915	655,045,000	622,012,000
1914	684,990,000	675,623,000
Average 1909-1913	441,212,000	389,382,000
Spring Wheat:		
1915	356,460,000	308,290,000
1914	206,027,000	203,057,000
Average 1909-1913	245,479,000	199,253,000
All wheat:		
1915	1,011,505,000	930,302,000
1914	891,017,000	878,680,000
Average 1909-1913	686,691,000	588,635,000
Oats:		
1915	1,540,362,000	555,569,000
1914	1,141,060,000	499,431,000
Average 1909-1913	1,131,175,000	424,047,000
Barley:		
1915	237,009,000	122,499,000
1914	194,953,000	105,903,000
Average 1909-1913	181,873,000	108,364,000
Rice:		
1915	28,947,000	26,212,000
1914	23,649,000	21,849,000
Average 1909-1913	24,016,000	19,559,000
Potatoes:		
1915	359,103,000	221,104,000
1914	409,921,000	199,460,000
Average 1909-1913	356,627,000	215,893,000
Hay:		
1915 (tons)	85,225,000	912,320,000
1914 (tons)	70,071,000	779,068,000
Average 1909-1913	65,987,000	800,670,000
Tobacco:		
1915 (pounds)	1,060,587,000	96,041,000
1914 (pounds)	1,034,679,000	101,411,000
Average 1909-1913	996,087,000	104,099,000

Corn:

1915 (Bales)	11,161,000	502,395,000
1914	16,135,000	525,324,000
Average 1909-1913	13,033,000	743,428,000

Apples:

1915 (barrels)	76,670,000	156,407,000
1914 (barrels)	84,400,000	156,140,000

The United States exports more agricultural products than any other country in the world, and the value in a normal year is more than the total value of the exports of all classes of goods from any nation excepting the United Kingdom, Germany, France and the Netherlands.—[From an article by J. J. Macfarlane in *Feb. Commercial America*.]

SUGAR IN THE UNITED STATES

More than one-fifth of the 40,000 million pounds of sugar that represents the world's production last year was consumed in the United States.

Of the sugar consumed in the United States in 1914-15, 1941 million pounds were produced on the mainland, 1281 million pounds in Hawaii, 589 million pounds in Porto Rico, 327 million pounds in the Philippines, and the remainder in foreign countries. Cuba, the leading source of imported sugar, sent 4785 million in the last fiscal year, that quantity being nearly four times as much as that from Hawaii and eight times as much as that from Porto Rico.

Beet sugar now leads cane sugar by nearly 1000 million pounds in the yearly domestic product, having reversed the conditions which obtained twenty years ago. In 1895, for example, according to the Statistical Abstract of the United States, the domestic sugar product totaled approximately 775 million pounds, the share of beet sugar being only 45 million pounds. In 1915 the American sugar product had increased to 1941 million pounds, the share of beet having grown to 1448 million and that of cane having decreased to 493 million pounds. Meantime beet sugar has practically disappeared from the imports. Eighteen years ago, when the Cuban supply of cane sugar was cut off by the war, the United States imported nearly 2000 million pounds of beet sugar. After the return of peace in Cuba the imports of beet sugar fell off sharply, and in the last fiscal year beet sugar imports amounted to less than one million pounds.

The cutting off of the sugar supply of European countries has resulted in a remarkable expansion of American sales of sugar to foreign countries. For the fiscal year 1915 they aggregated 582 million pounds, as against 22½ million pounds in 1900 and 40½ million pounds in 1880.

The following table presents the leading changes in the economic position of sugar in 1914-15 as compared with the preceding year:

	1913-14	1914-15
	Millions of pounds	
World's product	42,053	40,424
United States cane product.....	601	493
United States beet product.....	1,467	1,448
United States imports: Cuban.....	4,927	4,785
Hawaiian	1,115	1,281
Porto Rican	641	589
Philippine	117	327
All other	18	309
United States exports	72	582
United States consumption.....	8,794	8,630
	[Commercial America.]	

GEOGRAPHY: ITS FIELD AND ITS FUTURE

*Excerpts from a paper read before the Manchester, Eng., Geographical Society,
by Mr. J. Hutcheon.**

OF recent years, in educational circles, perhaps no subject has been more frequently discussed than geography. . . . The science is almost as old as man, for, as soon as he found that his immediate environment could not supply all his needs, geography began. . . .

The geographer's field of action is the surface of our globe, and by that term is meant such parts of the atmosphere, lithosphere, and hydrosphere as have been investigated. He borrows from the results obtained by the geologist, the meteorologist, the anthropologist, and others, and shows how the distributions of their phenomena are inter-related. In his science, as in all others, there are three stages, namely, the collecting, the classifying, and the explanatory. The first deals with the gathering of as large a number of independent facts as possible, the second with the arranging of these, and the third with the determination of the laws regulating them.

It must therefore be apparent that few subjects can profess to train more effectively the powers of observation, comparison, explanation, and imagination. The educational value of the subject is very great, whether it be considered from the points of view of utility, culture, or discipline.

Perhaps a rapid review of the development of geographical education in other countries would be of interest. The truest indication of what value is placed upon a subject is the degree of recognition it receives from the universities.

At Paris, more than a hundred years ago, the first professorship of geography was established. Now France can boast of nearly fifty university teachers of the subject, and she has produced some of the world's greatest exponents of the science. Forty years ago geography was taught at only two of

*Published in full in the November, 1915, *Journal of the Manchester Geographical Society*.

the German universities; at present there are close upon three score professors and lecturers. Similar progress has been made in Austria, Switzerland, Italy, Denmark, and the Netherlands. At Oxford the first readership in geography was established in 1887, and at Cambridge the study of the science began the following year. The practical branches of the subject have attained so high a standard in England, that students are attracted from all parts of the world, for, by the sustained efforts of several pioneers, staunchly supported by the Royal Geographical Society, the School of Geography at Oxford and the department at Cambridge can compare favorably with any elsewhere.

In what relation does Geography stand to the other sciences? She has been called the mother of science, the handmaid of history, the child of geology, etc., and to attempt to account for such appellations is by no means an uninteresting task.

Although Geography builds with the bricks supplied by the geologist, the meteorologist, and the anthropologist, it does not follow that in order to be a geographer one must be an expert in all these branches of science any more than the doctor, who uses the results of geographical inquiry in order to find a suitable climate for his invalids, could be called a geographer. The trend of the teaching of the subject will depend on the particular bent of the teacher; if he be mathematical, then the astronomical and cartographical phases of the science will interest him; if geological, then the physical; if biological or anthropological, then the more human. . . .

To state the line of demarcation between geography and geology is very difficult. The same material is used by both but the point of view is different, for geology studies the earth's crust in order to find out its past history, while geography looks upon the present state of development of the various land forms, considers their future condition, treats the whole as the home of plant, animal, and man, and notes the influence of configuration, etc., on him and his reaction on nature. Another of its problems deals with the distribution of minerals and soils and their influence in the economic development of the regions concerned. . . . Anthropology shows that the influence of environment on man varies in inverse proportion to his mental development. The savage is practically a slave to his environment, while the modern man has all but conquered nature. The tendency in anthropo-geography is to make sweeping statements before sufficient data have been collected. . . .

RECENT PUBLICATIONS

TRAVELS IN ALASKA. By John Muir. Houghton Mifflin Company, Boston, 1915. xi+327 pp., \$2.50.

One of the most delightful books on travel published in America during the last year is John Muir's "Travels in Alaska." It is a description of glaciers, fiords, and mountains, and deals with the author's journeys in 1879, 1880, and 1890. It was not quite finished at the time of his death, although

he seems to have substantially completed the narration of his travels in the three seasons cited. Had he lived to carry out his description to the end, he would have doubtless gone on to tell of what he saw and thought and felt during his trip in 1899 with the Harriman Expedition. He then went to the glaciers of Yakutat Bay and Prince William Sound, as well as to Glacier Bay, where he had previously described the ice tongue which others subsequently named Muir Glacier.

The book furnishes not only a charming and gripping description of the coast of southeastern Alaska, as it was a third of a century ago, but also a great deal of information about the natives and their habits of life. It gives a vivid picture of the aborigines before they had been greatly affected by white men; it reveals the man Muir—as a naturalist, as a philosopher, as a reverent worshipper of outdoor beauty.

Most people will enjoy reading the book from cover to cover; the reviewer took greatest pleasure in Muir's retelling of the immortal story of the dog *Stickeen* and his trip with Muir over the Brady Glacier, in the discussion of Muir Glacier, and in the narrative of the discovery of Sum Dum Bay. The latter is now generally called Holkham Bay, and Muir seems to have been the first to explore it. It is quite likely that at the time of Vancouver's explorations the glaciers were much larger and completely filled the whole fiord. When Muir explored this fiord in 1880 the recession of the ice tongue had revealed miles of ice-sculptured fiord wall that reminded him tremendously of the Yosemite Valley. Indeed Muir gave to one branch of Endicott Arm the name *Yosemite Bay*, a name lamentably replaced in recent years by the un-descriptive *Ford's Terror*. This likeness to the ice-wrought valleys of the Sierra Nevada led Muir to ascribe the Alaskan fiords to glacial erosion. He did this long before the relation of fiords to sculpture by ice was well recognized by geologists.

The reviewer can imagine no more delightful and instructive book for teachers to have, or to send their students to read in a public library.

LAWRENCE MARTIN.

ALASKA DAYS WITH JOHN MUIR. By S. Hall Young. Fleming H. Revell Company, New York, 1915. 226 pp., \$1.00.

The Reverend S. Hall Young was the missionary who accompanied John Muir in his Alaskan explorations of 1879 and 1880. He was the owner of the dog *Stickeen*, described so wonderfully by Muir. But more than this, he lived and worked in Alaska for more than thirty years, so that he knows the country and the people of the country he describes. His "Alaska Days with John Muir" deals only with his journeys with his friend during the first two years of his life in Arctic America. The book will be read with keen interest by all who knew and loved Muir and especially by those who read Muir's last book, reviewed in this magazine. Young tells with directness and simplicity of the exploring trips which took them up the Stikine River, into Glacier Bay, and through the fiords from Wrangell to the head of Lynn Canal. It supplements without duplicating Muir's descriptions. Young's

descriptions of the land itself are clear and interesting. The reviewer confesses to a greater interest in the additional information about the man *Muir* and the dog *Stickeen* than in any other parts of the book. Nevertheless the descriptions of the life of the natives are interesting and valuable.

LAWRENCE MARTIN.

GEOGRAPHY AND WORLD POWER. By James Fairgrieve of the University of London. viii+356 pp., 5x7 inches. Published by the University Press, London, 1915. Price, 3 shillings.

Not, as its title might suggest, a hastily written book intended merely for "war consumption." It is full of thought and suggestion. It is an attempt to get at some of the geographical foundations of History and of political power. Much stress is laid upon stores of *Energy*. The author says: "It may be said that in its widest sense, on its material side, history is the story of man's increasing ability to control energy." "History must be controlled by the distribution of energy." His conclusion is that world power must eventually reside with those nations that have great stores of energy—coal. The chapters cover a wide range,—Egypt, Babylonia and Assyria, Palestine and Phoenicia, Greece and Carthage, Rome, Mohammedan lands, Iberia, Holland and France, Britain, Russia and Germany, China, India, Spanish America, and the United States. While intended for use as a text-book, it is no less useful for general reading; and it is worth reading.

THE WONDERS OF THE JUNGLE. By Prince Sarath Ghosh. Cloth. Illustrated. 190 pages, 5x7 inches. D. C. Heath & Co., Boston, New York, Chicago. 1915. 48 cents.

A collection of animal stories written by a native prince of India, whose intimate knowledge of animal life and sympathy with the child's point of view have created a book of unusual interest. The author tells in a conversational way how the animals of the jungle live, how they protect one another, how they care for and train their young, and how they adapt themselves to their surroundings. The stories have a strong human element and aim incidentally to teach lessons in manners, morals, and good conduct.

IRRIGATION IN THE UNITED STATES. By Ray Palmer Teele, Irrigation Economist, U. S. Dept. of Agriculture. x+252 pp., 5x7 inches. D. Appleton and Co., New York. 1915. \$1.50 net.

The book is intentionally economic rather than geographic. The author says that he has prepared the book for the benefit of persons contemplating settlement in the arid sections of the country. He discusses some of the geographic aspects of irrigation, including climate, ground water, streams, etc. One chapter is historical; others treat of legislation, investments, operation of irrigation enterprises, and the future of irrigation in the United States. In his concluding chapter he says: "Past experience and the present situation seems to indicate that irrigated lands cannot be expected to repay directly the cost of irrigation works, with interest, as is ordinarily expected of investments generally; . . . if loss to original investors is overlooked, irrigation has been a decided success."

"WHY'S" IN ECONOMIC GEOGRAPHY

MANUFACTURES AND CITIES OF THE UNITED STATES

1. Why is iron and steel manufacturing carried on mainly in the north-eastern quarter of the United States?
2. Why did manufacturing get a late start in the South?
3. Why is Chicago rather than St. Louis the railroad center of the Middle West?
4. Why is the manufacture of clothing so largely centered in New York City?
5. Why is the Pennsylvania Railroad considered to occupy the most favorable traffic territory in the United States?
6. Why has traffic on our rivers declined while that on the Great Lakes has increased?
7. Why have we a very large fleet engaged in coastwise trade but a very small one in over-sea trade?
8. Why have the ship-building industries of New England declined while those of the Delaware-Chesapeake region have increased?
9. Why has Cleveland passed Cincinnati in size and industries?
10. Why has Buffalo declined in *relative* importance as a Great Lakes port?
11. Why have the Gulf ports outgrown the South Atlantic ports in commerce?
12. Why has Detroit grown so rapidly in the past decade?
13. Why have the cities of northern New Jersey grown rapidly in recent years?
14. Why is Ohio an exceptionally favored state in industrial advantages?
15. Why has Michigan no important city on Lake Michigan?
16. Why has New York no important city on Lake Ontario?
17. Why are there no ports of the first rank on any of the excellent harbors of Maine?
18. Why has New York outstripped both Boston and Philadelphia?
19. Since the chief cities of Wisconsin, Michigan, Illinois, and Ohio, respectively, are on the Great Lakes, why is it not true also of Indiana?
20. Since the junction of large rivers is a favorable place for an important city, why is Cairo, Ill., not larger?
21. Why are our South Atlantic ports less important than those of the North Atlantic?
22. Why are there few large cities on the Pacific Coast?
23. Why can there be two large, thriving cities—St. Paul and Minneapolis—so near together? Same for Jersey City and Newark?
24. Why has cotton manufacturing gained no hold west of the Appalachians?
25. Why is flour-milling so widely distributed, and yet so important in a single city, Minneapolis?
26. Since the major part of our iron ore is mined in Minnesota, why is little iron and steel manufactured there?
27. Why is the northern part of the southern peninsula of Michigan not likely to have a large city? Northern Maine? Northern New York?

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A GREETING

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THE PHYSICAL GEOGRAPHY OF WASHINGTON

By Edwin J. Saunders

Department of Geology, University of Washington

GEOGRAPHY

WASHINGTON is located in the northwest corner of the United States, directly west of the most accessible passes across the northern Rocky Mountains. It is therefore on the natural trade route between the north central states and the Orient. It is also the nearest shipping point to Alaska. Its location, commodious harbors, varied climate, and great natural resources all combine to make the "Evergreen State" an important factor in the future development of the Pacific Coast.

The state is roughly rectangular in form. The greatest length east and west is 360 miles and the greatest width 240 miles. Its total area is 69,127 square miles including 2291 square miles of water surface. It ranks nineteenth in size, exceeding in area the New England states.

PHYSICAL DIVISIONS*

Washington includes portions of the five western physiographic divisions of the United States. Named in order from the west coast these are: the Coast Ranges, the Pacific Coast Valleys, the Cascade Mountains, the Lava Plateaus, and the Rocky Mountains. In a journey across the state these features present an everchanging panorama of low-lying plains, rugged mountains surmounted by snow-clad volcanic cones, and broad plateaus deeply trenched by one of the largest rivers of America. The great variation in rainfall, temperature, soil, and vegetation is the result of these diversified physical features.

Cascade Mountains.—The most prominent feature of relief in Washington is the Cascade Range which divides the state climatically as well as physically along a north and south axis into two quite dissimilar sections. This range varies in width from 50 miles at the Columbia River to 125 miles at the British Columbia line. Viewed from any of the higher peaks the general level of the ridges gives the impression of a deeply dissected, slightly undulating plain. The average elevation of the crest is from 5000 to 6500 feet, with many remnants above this level and a number of passes cut to a level of 3500 feet. These passes have been used by the railroads crossing the state. The Columbia River has cut a much lower gap through the mountains and thus

*See physical map on opposite page.

forms a natural boundary between Washington and Oregon. Surmounting the maturely dissected mass of the Cascades are five large volcanic cones, recently built, and now considered extinct.

Mount Rainier, 14,408 feet high, rises about 7000 feet above the surrounding ridges and carries on its furrowed slopes thirteen glaciers radiating from an immense snow cap to the deeply eroded valleys below. To protect its forests and other natural beauties the United States government has set aside the Mt. Rainier National Park. Because of its glaciers, lakes, cascades, canyons, and broad parks of wild flowers it is considered one of the beauty spots of America. The ease with which it is reached from Tacoma or Seattle in a one day trip is making it a very popular resort.

In the northern part of the Cascades, Mt. Baker (10,750 feet), another large volcanic cone, somewhat less rugged than Mt. Rainier, rises 5000 or 6000 feet above the western flanks of the range. Mt. Baker carries seven glaciers, and is easily reached from Bellingham. A short distance south of Mt. Baker but less prominent because nearer the crest of the main range is Glacier Peak (10,436 feet). This can be seen from the Sound as a great white sugar-loaf. It carries several active glaciers radiating from a common snow cap.

Between Mt. Rainier and the Columbia River Mt. Adams (12,307 feet) and Mt. St. Helens (10,000 feet) rise like sentinels from either flank of the Cascade range. Both have small glaciers on their slopes and with Mt. Hood south of the Columbia River have been described as "The Guardians of the Columbia."

The Coast Mountains. The mountains along the coast of Washington are best described as two distinct divisions, the Olympic Mountains north of Grays Harbor and the Coast Ranges of southwestern Washington between the Columbia River and Grays Harbor.

The Olympic Mountains occupy a large triangular area between Grays Harbor and the Juan de Fuca Straits. Viewed from an elevation they suggest an uplifted, maturely dissected peneplain with main axis of uplift running northwest from Hood Canal to Cape Flattery. The general level of the ridges is between 4000 and 5000 feet, but numerous monadnocks above this level are 6000 to 7000 feet high. Rising athwart the path of the prevailing westerly winds they are subject to the heaviest precipitation in the United States. The higher peaks are snow capped and carry smaller glaciers. Their lower slopes are deeply trenched by numerous valleys due to the heavy rainfall. The upper valleys show decided effects of former glaciation. The rocks of the central axis are a complex series of metamorphosed sediments and intrusive igneous rocks. Bordering the mountains is a low plain of river gravels and sand, wider on the southwest side, scarcely showing on the Hood Canal side. The slopes are heavily timbered and the whole wild rugged area is probably the least known of any area in the United States. The central portion has been set aside as a forest reserve and part of it as a national monument.

The Coast ranges of southwestern Washington are a series of low heavily timbered hills irregular in shape and direction. The maximum elevation is about 3000 feet and they form a divide for the short streams draining into Willapa Bay and Grays Harbor on the west and the interior valley on the east.

The Great Pacific Valley. Between the Cascades and Olympics a broad trough-like depression extends across the state. The northern part of the trough is known as Puget Sound Basin. It was built up as a broad plain of glacial gravels and clays, burying an older irregular topography between the foothills of the mountains. Following erosion the north and south valleys in the plain were overdeepened by a later advance of the glaciers, and when the ice receded these valleys were partially submerged to form Puget Sound. The submergence caused the isolation of many of the higher land masses as islands separated by deep channels. The most northerly group of these make the San Juan Archipelago. Some of the islands have since been united to the mainland by river, wave and current work.

The Southern part of the valley is known as the Columbia-Cowlitz valley. It is made up of a number of irregular rock knobs partially buried by river gravels and alluvium.

The Columbia Lava Plateau. East of the Cascade Mountains a large part of the state south of the Columbia and Spokane rivers is composed of lava flows. Where rivers have cut into the plateau it is seen to be made up of a series of lava beds, in some places aggregating 4000 feet in thickness. Immense floods of lava, welling up through numerous fissures, overflowed this part of the state burying all irregularities except a few of the higher ridges and peaks. Slight warping since the flows occurred has caused ridges like the Badger Mountains and Rattlesnake Hills. The Columbia River in its present, and in other temporary courses, has cut immense trenches below the otherwise unbroken surface. Wind work has been effective in many sections in building up numerous small irregularities in the form of low sand dunes and ridges. Due to the low rainfall in this section it was formerly an extensive sage brush desert, except along the streams. The soil however is rich and under irrigation large areas have been reclaimed and have become very productive.

The Blue Mountains. A spur from the Rocky Mountains that was not buried by the lava extends across the southeast corner of the state into Oregon as a broken ridge about 6000 to 7000 feet high. The general elevation is about 4000 feet above the surrounding plateau and on account of increased precipitation, due to their elevation, the surface is deeply scarred by numerous river valleys. The slopes are timbered and because of the contrast in color with the surrounding country this division both in Washington and Oregon has been called the Blue Mountains.

Okanogan Highlands. A northern spur of the Rocky Mountains, extending westward to the Cascade Mountains north of the Columbia and Spokane rivers, is known as the Okanogan Highlands. Although not so

rugged as either the Cascades or Olympics they are 5000 to 6000 feet in elevation. They consist of a series of north and south ridges rounded off by glacial erosion, sloping gently to flat valley floors. Many intrusive granitic rocks are present and deposits of rich mineral ore and good building stone are quite common in the section north of Spokane.

GEOLOGICAL HISTORY

The earliest rocks of known age found in the state are Cretaceous, but there is a great series of older rocks of which the definite age has not yet been fully ascertained. These give us a complicated record of sedimentation and volcanic activity. A succession of movements caused the land to be submerged at times and then exposed to erosion in part at least. The sedimentary rocks thus formed were subjected to lava intrusions and flows which greatly changed the nature of the older rocks. These rocks are found in the Olympics, the northern Cascades, and the Okanogan Highlands.

In the early Tertiary or Eocene period there were low-lying land masses where the Cascade and Olympic Mountains are located at present. The erosion of these land masses furnished sediments which were laid down in a large embayment extending from the Columbia River to the San Juan Islands. The rivers drained into large estuaries which later became swampy, and the lowlands about them supported a luxuriant growth of vegetation. A slight submergence caused the preservation of the vegetation and these beds covered by silt formed the coal beds of western Washington. In some sections more than one hundred of these coal beds are known, each one representing a period of vegetable growth near sea level, with intervening periods of submergence and sedimentation. Since their formation, the coal beds, probably laid down in almost horizontal position, have been folded and tilted strongly and are found at all angles.

In central Washington there were large lake basins in which sedimentation and coal formation was taking place. The Roslyn and other coal beds were formed in this way. Flows of basaltic lava varying in thickness up to 3000 or 4000 feet, were interbedded with these Eocene sediments in both sections of the state.

In the middle Tertiary or Miocene period the waters of the western Washington embayment were partially drained to the north and south by uplift, and sedimentation continued in these smaller embayments. Lava floods welling up through numerous fissures covered practically all of eastern Washington south of the Okanogan Highlands, and extended into Idaho and Oregon. This molten mass hardened to form the black basalt so common in the plateau section. That these flows occurred at long intervals is shown by the presence of petrified trees and stumps between the lava beds, meaning a period long enough for large trees to grow on the surface of previous flows. Thin strata of sediments also occur between the beds. The maximum thickness is about 5000 feet, and eight sheets have been counted along the Yakima River.

Some of the higher knobs of the old surface such as Steptoe Butte and the Blue Mountains were not entirely covered. A series of sediments composed of river gravels, volcanic ash, and possibly lake deposits was spread over the lava surface by drainage from the old Cascade Mountains.

A general uplift about the close of the Miocene caused all the embayments and lakes to be drained. The Pacific coast was probably farther west than at present. Active erosion through the upper Tertiary or Pliocene period reduced the whole state to a low, irregular plain or peneplain sloping toward the Pacific Ocean as a great basin drained by the Columbia and other rivers. The closing event of the Pliocene period was the uplift and warping of the peneplained area to form the present Cascade and Coast ranges and the Olympic Mountains. The surface of the lava plateau in eastern Washington was also folded or warped up at this time to form ridges like the Badger Mountains and Rattlesnake Hills. These movements were slow and the rivers were able to maintain their courses across the uplifted ridges. Thus the Columbia cuts through the Cascade Mountains and the Yakima through the folds between Ellensburg and Yakima and Union Gap south of Yakima.

The irregular surface thus elevated to form the present Cascade Mountains has been called the "Cascade or Pliocene Plateau," and the present valleys and ridges are the results of erosion since uplift. The same is true of the Olympic Mountains, and in either case one can easily get an idea of the reconstructed surface from any of the higher peaks. During the uplift, or at the climax of it the volcanic cones already described were built on the surface of the Cascade block. The other peaks of the Cascades and all the higher peaks of the Olympics are remnants of erosion left as monadnocks above the peneplain due to irregularities in resistance of the rocks, and in stream distribution.

Following the uplift at the close of the Tertiary, or during the early Quaternary period the climate gradually changed so that deep snows collected on the mountains and formed extensive glaciers. These mountain glaciers over-deepened the valleys already begun by river erosion and caused the formation of tributary cascades from hanging valleys, many small lakes and steep-walled valleys. From British Columbia a great glacier moved down the Puget Sound trough as far as Tenino. It eroded the surface, rounding off rock knobs in the northern part, and deposited a heavy drift in the southern part of the basin. As it receded heavy deposits of gravel carried by water from the front of the ice formed extensive gravel plains throughout the area. Regular river systems with north and south trunk streams dissected these plains. A second advance of the glacier again filled the Puget Sound basin. It over-deepened the north and south valleys, but obliterated many of the east and west valleys, thus leaving the basins that were later filled by Sound waters. It also shaped many of the irregular ridges over which it passed, leaving the many rounded hills with long north and south axes. A thin veneer of glacial till was left on the slopes and tops of many of the gravel hills as seen in street cuts about Seattle, and the cliffs along the Sound. As

the last ice receded many temporary lakes were formed in which delta deposits, from the lateral streams and from the ice itself, were built and are now seen as regularly stratified deposits of assorted materials among the unassorted glacial deposits.

In the Mountains, after deepening the valleys and truncating the spurs, the glaciers in many cases left debris barriers in the lower ends of the valleys. Many of the larger lakes were formed behind such barriers and serve as reservoirs for water supply. The tributary streams cascade into the over-deepened main valleys and thus furnish excellent power sites. Glacial work in Washington is therefore an important factor in the economic development of the state's industries.

When the ice finally receded beyond the Juan de Fuca Strait, ocean waters filled the deepened valleys to form Puget Sound, the greatest deep-water inland harbor in the world. Rivers from the mountains have cut deep valleys through the glacial deposits and with their heavy loads of silt have filled in large areas of the sound connecting former island masses to the mainland and considerably increasing the agricultural lands of western Washington.

DRAINAGE

The entire drainage of the state passes finally to the Pacific Ocean from three large drainage areas. These are the Columbia River basin, the Puget Sound basin, and the Coastal belt or Pacific basin.

The Columbia River basin includes all of Washington east of the summit of the Cascade range, and a large area in southwestern Washington as well as the greater part of Oregon and Idaho. The Columbia River, winding its way from the northeast to the southwest corner of the state, has cut a gorge-like canyon through the lava plateau. Even through the Cascade Mountains it was able to maintain its course during uplift and the canyon thus cut is notable for its magnificent scenery. A boat trip from Portland up the river shows one the steep walls of basaltic rock rising 2000 to 4000 feet above the river. Small tributary streams cascade down these steep rock walls to join the boiling torrent, still busy cutting its way through the gorge. Canals at the Cascades and Dalles enable steamers to pass the worst rapids and make the river navigable to Priest Rapids 400 miles from the mouth. Numerous rapids below Wenatchee make continuous navigation here impossible, but above Wenatchee the river is navigable some distance beyond the mouth of the Okanogan River. A striking feature along the river, where it is not in a deep canyon, is the gravel terraces at different levels, continuous for long distances. Below the canyon through the Cascade range low-lying lands and broad swampy flood-plains border the river until the Coast range is reached where high rock hills rise directly from the wide estuary caused by drowning of the river mouth. An interesting event in the history of the Columbia River left its mark in eastern Washington. At the time of glaciation the Okanogan glacier from the north filled the upper Columbia valley at the "Big Bend" and the river diverted from its regular course cut deep gorges across

the lava plateau. Cataracts larger than Niagara Falls existed in these canyons and many deep pot-holes and basins were eroded in their beds. There may have been subsequent glaciation along these valleys. Many lakes, most of them with no outlets, and therefore mineral or alkaline, still occupy these depressions in the old valleys which are known as "Coulees;" Grand Coulee, Moses Coulee, Crab Creek, etc.

The eastern tributaries of the Columbia are few in number but among them is the Snake River, the largest of all, and some of them are very important on account of their use for water power. The Pend Oreille or Clarke Fork, and the Colville River flow through broad fertile valleys in the north. Spokane River flows in a broad valley, an old valley train filling of gravel, until it reaches Spokane where, cutting through the gravel filling, it has come upon a hard ledge of rock over which it falls in a series of cascades. These yield abundant power for the whole "Inland Empire." Below the city it flows in a deep canyon between high terraces, with occasional rapids some of which are used for power. Of a possible 230,000 horse power about 45,000 horse power is developed. About the upper falls the city of Spokane has grown.

The Snake River enters the state near the southeast corner and flows in a deep canyon through the lava plateau. It is navigable from its mouth to the state boundary and by the removal of a few protruding rock ledges may be made navigable for many miles in Idaho. Falls higher up in its course furnish much water power.

Many large tributaries from the Okanogan Highlands and the Cascade Mountains enter the Columbia from the north and west. Abundant precipitation in the mountains and numerous lakes and snowfields give these tributaries a fairly uniform supply. The Okanogan River is the largest of three rivers flowing in almost parallel valleys from the north. It is navigable for some distance except in extremely low water and is bordered by a wide fertile valley. One of the latest government irrigation projects is located in this valley and will make usable a large acreage of otherwise unused land. The other rivers in this section are the Methow, and the San Poil.

Lake Chelan, lying between high mountains of granite, is held about 400 feet above the Columbia River by a barrier of morainal drift in the lower end of an old river valley. Its surface is about 1100 feet above sea level and the glaciers have gouged the valley to a depth of 400 feet below sea level making the lake about 1500 feet deep. It is about 50 miles long and only 2 miles in width. Nestled in the mountains it is one of the many scenic spots in Washington. Chelan falls at the lower end of the lake and Stekekin falls at the upper end of the valley add to the beauty as well as to the available power in this section.

The Wenatchee River with a natural reservoir in Lake Wenatchee has eroded a low grade valley into the very heart of the Cascade Mountains. The Great Northern railroad follows this valley as far as Leavenworth where it

begins its steep ascent to the Cascade tunnel. Several power plants are located along the river.

The Yakima River is the largest eastward flowing tributary of the Columbia. Three large lakes, Keechelus, Kachess, and Clealum formed behind morainal barriers in almost parallel glacial valleys serve as reservoirs. The capacity of each of these basins has been increased by dams to furnish water for the irrigation of thousands of acres of fertile land lying along the Yakima valley. The river flows through deep canyons where the lava plateau has been arched up across its path and through broad open valleys where softer rocks have permitted more mature erosion. The orchard lands are even more extensive than along the Wenatchee Valley, and large shipments of fruit are made every year. Many power plants along the main stream and its tributaries furnish electricity for local use. At Clealum the Roslyn-Clealum coal field is exposed by erosion. The Northern Pacific and the Chicago, Milwaukee & St. Paul railroads use the low grade valley, entirely, and in part, for their route across this section into the Cascade Mountains.

The Puget Sound Drainage basin includes rivers from the western slopes of the Cascades and those from the eastern and northern slopes of the Olympics. Their valleys have been strongly glaciated and they flow from short steep valleys with many falls and rapids well adapted for power sites. Many power plants have already been installed but only a small fraction of the available power is used.

The Skagit River has the largest drainage basin and has formed the largest alluvial deposits. The delta of the Skagit or the La Conner flats and the flats for miles along the valley furnish the largest and best area of agricultural land in western Washington. The river is navigable for sixty miles through this broad flat.

The Cedar, Green, White and Puyallup rivers have combined in filling up what was formerly part of the Sound behind the high land area which has been called "Des Moines Island." In so doing part of the Sound was shut off to form Lake Washington, and the broad fertile Duwamish-Puyallup valley was left to supply Seattle and Tacoma with their garden truck. The streams draining the north and east slopes of the Olympics are short and swift affording many excellent power sites.

The Pacific drainage includes many minor streams along the western border of the state from Cape Flattery to Columbia River. The important streams on the Olympic Peninsula are the Soleduck, Hoh, Queets and Oquilet. These drain the heavily timbered slopes of the Olympics and may some day be important in facilitating the handling of the timber of this extensive area.

LAKES

Numerous lakes have been formed in the Olympic, Cascade and Okanogan Mountains by glacial erosion and deposition. These are in the form of

very small rock rimmed lakes in glacial cirques or in long, trough-like valleys. The glaciers at one time filled these valleys and built across them morainal deposits behind which the waters have since collected to form lakes. Many lakes irregular in size and shape are found among the uneven glacial deposits about Puget Sound and along the Straits. Among these are Crescent, Whatcom, Sammamish, Union, and Washington. Lake Queniult and Ozette are in the valleys of the same name at the foot of the western slopes of the Olympics. Queniult although 35 miles from the ocean is only 300 feet in elevation and Ozette only 50 feet above sea level. In central Washington numerous lakes are found in old abandoned stream channels and in small basins formed by wind blown sand. Many of these on account of low precipitation and lack of outlet are intermittent or if permanent are strongly mineral.

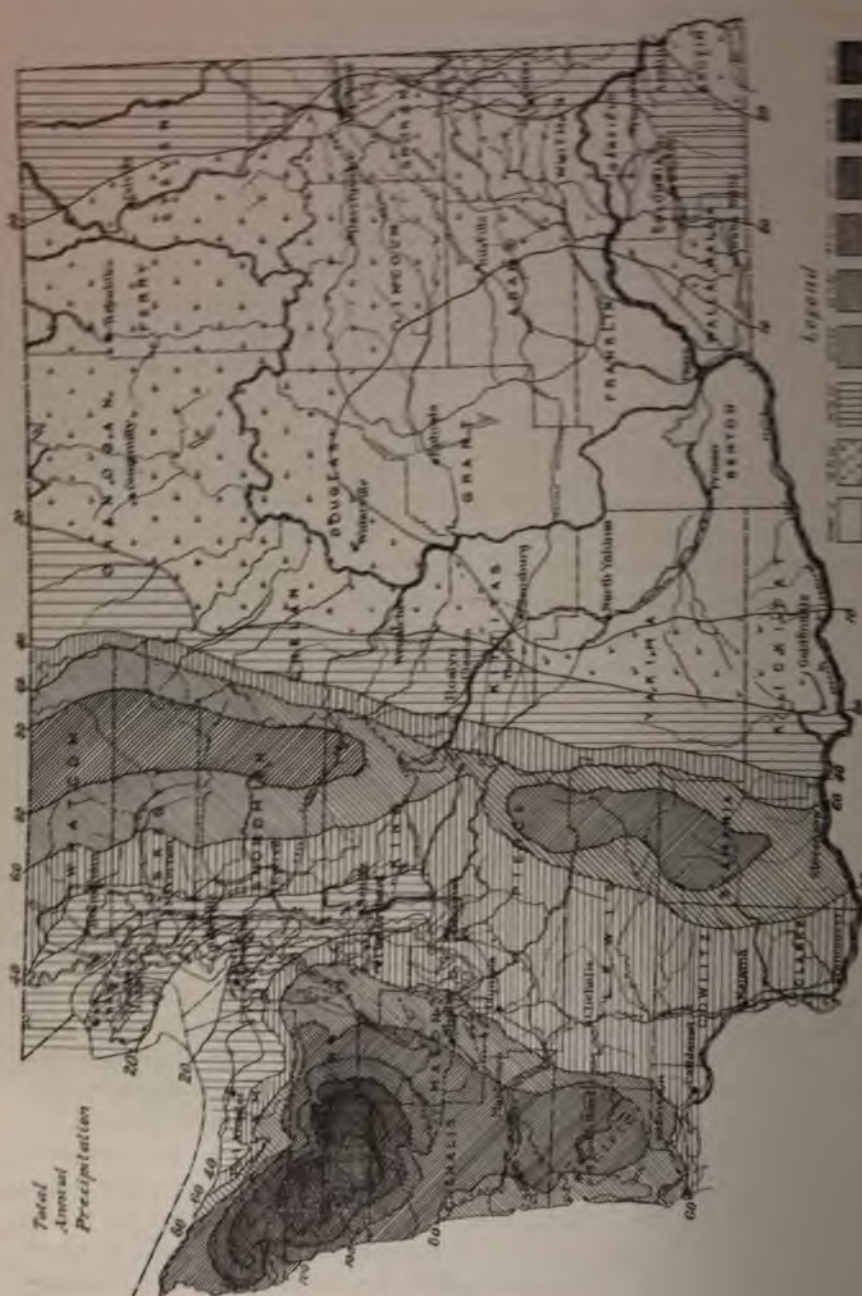
COAST LINES

Four great embayments, due to the submergence of a deeply eroded land mass, provide Washington with more than 2000 miles of shore line. This does not include the Columbia River, now navigable throughout its entire length along the southern border of the state.

Puget Sound, formerly applied only to the southern portion of the vast inland sea, now includes all American waters in this section. The total area is over 2000 square miles and on account of the numerous indentations and islands formed by submergence, its shoreline is about 1700 miles. It reaches a maximum depth of 900 feet, is deep close into the shore in many places and practically free from shoals. The southern end is protected from strong winds and is therefore an excellent harbor. Cliffs in the glacial drift form the greater part of the shore, but large river deltas and river flats extend for miles in some sections. Sandspits and bars formed by waves and shore currents have been effective in connecting former islands with the mainland and in a few cases enclosing fairly good harbors, as at Port Angeles and Dungeness.

The rivers along the Pacific coast have all been subject to submergence but in only three of them has this resulted in an embayment which can be used as a harbor. Either the stage of erosion was not far enough advanced when submergence occurred or a slight elevation since submergence, together with river filling, has obliterated any embayments that were formed. Grays Harbor, Willapa Bay, and the Columbia Estuary have been partially separated from the ocean by long sand spits or bars built by shore currents, thus shutting off as good harbors what would otherwise have been broad bays open to the severity of the ocean storms. It has been necessary to build jetties at Columbia River and Grays Harbor to keep the bar from entirely closing the harbors to navigation.

With these unexcelled harbors and opportunities for shipping, the development of Alaskan and Oriental trade, and the opening of the Panama Canal, are of great importance to the coast cities and to the state as a whole.



in general to be more equable in temperature than other states in the same latitude. But on account of the great variations in altitude and the north-south trend of the physical divisions, no other state in the Union shows greater diversity in climatic conditions. The western lowlands, exposed directly to the moist ocean winds have a marine climate, moist and warm in the winter, dry and cool in the summer. The eastern section, because of the Cascade barrier which partially shuts out the oceanic influence, has much colder winters, warmer summers, and less rainfall than the coastal belt, thus approaching continental conditions, although somewhat protected from prolonged periods of extremes in temperature by the mountains north and east of the area. The higher mountain masses show all the peculiarities of high latitude climates with perpetual snow, glaciers, lower temperatures, and greater precipitation.

Precipitation. From the variation in total annual precipitation, the state may be divided into several rainfall belts following the general trend of the major physical divisions. (Fig. 1.) A large area along the Pacific Coast has an annual rainfall of over 60 inches and is known as the "Coastal wet belt." The warm moisture-laden winds moving inland are forced to ascend the slopes along the coast and in some parts of the Olympic Mountains the rainfall is over 140 inches, the greatest in the United States.

Farther inland there is a gradual decrease in rainfall, but when the moist air is forced to ascend the western slopes of the Cascades a second belt with rainfall exceeding 60 inches is the result. This belt extends over the summit of the mountains and at many points the rainfall probably exceeds 100 inches. It has been called the "Cascade wet belt."

Between these two wet belts, in the Puget Sound basin the annual rainfall varies from 60 to 20 inches. The low summer rainfall makes irrigation necessary for the best results in growing fruits and garden truck. This belt is known as the "moist belt." The decrease in precipitation as the air moves inland through the Grays Harbor lowland is remarkable. Aberdeen has a total rainfall of 85.57 inches, Olympia 54.96 inches, Tacoma 42.26 inches, Seattle 34.36 inches, and Port Townsend 20.68 inches. The difference along the Straits of Juan de Fuca is also striking with Tatoosh and Neah Bay 84.43 inches, Port Crescent 42.05 inches, Port Angeles 29.81 inches, and Port Townsend 20.68 inches.

As the air moves down the eastern slopes of the Cascade range and out over the Columbia River basin the rainfall rapidly decreases to less than 20 inches. The air has lost its moisture and being dynamically warmed is able to take up moisture and therefore causes scant precipitation and clear skies. There is a narrow belt at higher altitudes with rainfall between 60 and 20 inches known as the "Cascade moist belt," or a transition belt between the heavy summit and the low interior precipitation.

The whole central portion of the state has less than 20 inches of rainfall and a large area in this "dry belt" has less than 10 inches a year and may be called the "arid belt." The rapid decrease in rainfall is well shown in the

stations along the Northern Pacific railway: Martin 80 inches, Clealum 25.91 inches, Ellenburg 9.79 inches, North Yakima 8.67 inches, Kennewick 6.34 inches.

A third belt in which rainfall is above 20 inches is found along the eastern border of the state. With increasing elevation the rainfall increases and the Blue Mountains and Okanogan Highlands are included in the "eastern moist belt."

In those sections where the precipitation is above 20 inches is found the growth of timber that has made Washington the foremost lumber state. In some sections of central Washington dry farming has been very successful, but in the arid belt which was formerly a sage-brush desert little farming can be carried on successfully without irrigation.

Washington as a whole has a wet winter season and a dry summer season but the distribution throughout the year in different sections varies considerably. In western Washington between 70 and 75 per cent of the total precipitation occurs in six months and from 85 to 90 per cent in eight months, October to May inclusive. Of the remaining four months July and August have very low rainfall, less than 1 inch each. The number of days with rain will be between 130 and 200 with 100 to 150 clear days. In eastern Washington little more than half the annual precipitation occurs in six months, and there is more rain in May and June than in the other dry season months. The average number of days with rain in this section is 40 to 70 and the clear days 150 to 220.

The winter maximum of precipitation is accounted for by the numerous cyclonic storms of that season and by the rapid condensation of moisture in the air as it blows over a cold land from the ocean and usually from south to north. In summer the storms are less numerous and intense and the winds from the ocean and northerly quarter are blowing over warmer lands. The slight summer maximum in central Washington is explained by the occurrence of convectional storms typical of the summer season in interior states.

Snowfall. The snowfall varies from 10 inches annually for the coast and the lower central stations to over 100 inches for the mountain stations, and as high as 572 inches or about 48 feet has fallen at certain stations during one winter season. The average for a number of sections is as follows: Coast stations 9-10 inches, Puget Sound 13 inches, Western slope of Cascades 60 to 70 inches, Mountain stations over 100 inches, Sunnyside 8 inches, Wenatchee 70 inches, Spokane 38 inches. The length of time that the snow remains on the ground varies from a day or so for coast stations to 10 or even 12 months for some points along the summit of the Olympics and Cascades. This is significant in the river supply from melting snows, the high water of snow supply coming along in late summer when the precipitation is low. The snow remains longer in eastern Washington where most needed to protect vegetation from the cold spells and heavy freezes which are more common in that section.

Humidity. Full records for the relative humidity are not obtainable but the readings from Seattle and Spokane will illustrate the difference between the two sections of the state. Sound stations show an average humidity of 83 per cent, decreasing from 89 per cent at 5 a. m. to 77 per cent at 5 p. m. Spokane shows a mean annual humidity of 65.3 per cent and stations along the Columbia such as Kennewick would probably be still lower.

Temperature. The variation in temperature conditions in different sections of the state is just as striking as the variation in precipitation. Due to the oceanic influence western Washington has only moderate changes in temperature. The high humidity of the air, the southwesterly winds in winter and northwesterly winds in summer, the rapid condensation of moisture in this section during the winter months, and the protection from the easterly winds, cold in winter, warm in summer, by the Cascade Mountains all combine with the ocean winds to cause low daily, monthly and annual ranges of temperature. Frequently for several days in the winter the temperature will not vary more than 5° but in the warmer summer days it will vary as much as 30° to 40°. The average annual range of temperature for the coast stations is about 20°; for Puget Sound stations about 24°, or from 38° to 62°; and for Cascade stations about 30°, or from 33° to 63°. Cold spells are infrequent, and only at long intervals does the temperature go as low as zero. The lowest temperature recorded is -8° at Vancouver. Hot spells in summer are also rare and, although 105° has been recorded, temperatures above 90° have been recorded at Seattle only 16 times in the past 21 years. The nights are usually cool even during the hot spells.

Eastern Washington, shut off from the warm moist ocean winds by the Cascade Range and lacking its protection from the easterly winds, is more subject to continental extremes of temperature. The mountains of British Columbia and the Rocky Mountains furnish a slight protection, however, from the interior influences, and the extremes of temperature are not therefore so frequent nor of such long duration as in the states farther inland. The average annual range is between 40° and 50° with winter temperatures about 20° to 30° and summer temperatures from 65° to 80°. The extreme range for any one station is 140°, but temperatures as low as -36° and as high as 115° have been recorded at different stations. Temperatures as low as -20° and as high as 100° are common, but the cold and warm spells are of short duration and are not felt as much as the figures might indicate on account of the low humidity of the air.

Growing season. As a result of the strong oceanic influence, the frequent southerly winds, and the consequent cloudy skies which prevent nocturnal radiation in the spring and fall, the growing season or the time between killing frosts in western Washington is much longer than in eastern Washington where clear skies prevail. The average season between the last killing frost in spring and the first in the fall for Puget Sound is about 200 days, from April 15 to November 1. For some of the stations this period is 250 days. In eastern Washington only 120 to 170 days are apt to be free

from killing frost, or from about May 1 to October 1. The occurrence of these late and early frosts is quite irregular however, as they may occur very late or early if a well developed anticyclonic area passes over the state. The stronger insolation partially compensates for the shorter growing season in eastern Washington, as there are a greater number of bright days. In the mountain sections frosts are apt to occur at any time during the summer especially if the air is clear and dry.

Winds. The prevailing direction of the wind is from the west but local topography and the passage of storms cause modifications in direction for different stations and at different times. The usual track of the low pressure areas is so far north in the state or beyond the British Columbia boundary that the winds, especially in the winter, are from the south and therefore warm. This also causes the cloudy, rainy weather so prevalent in the winter months. If the storms move farther south, northerly winds prevail, the weather is clear, and if a high pressure is well developed northeast of the state we get a spell of clear cold weather in winter, but northerly and easterly winds are not common.

In the summer months the storm centres are not well defined as they move over the state, and the high pressure over the Pacific Ocean causes strong westerly and northwesterly winds with clear sky and cool nights. The strongest winds ever recorded are between 50 and 60 miles an hour and tornado-like storms are practically unknown. Few thunderstorms occur in western Washington, and only occasional mountain thunderstorms in eastern Washington. The winds in winter are much stronger than in summer due to better development of the regular cyclonic areas as they come in from the Pacific Ocean or down the Alaskan Coast.

A warm, rain-producing wind from the southwest in western Washington is called the chinook. But it is on the eastern slope of the Cascade range that we find the typical chinook or foehn wind. The air in passing over the mountains has been deprived of its moisture content and in descending the eastern slope is dynamically warmed by increased pressure and blows over the Columbia Basin as a warm, dry wind, in winter often causing the rapid melting and evaporation of snow.

Mountain and valley winds are also common in all the larger valleys as the cold air at night drains to lower levels and the air during the warm afternoons flows upward along the slopes.

Summary. We thus have in Washington three general types of climate: (1) oceanic or marine with slight range in temperature and a decided winter maximum of precipitation; (2) continental with extremes of temperature slightly modified by proximity to the coast, and a slight summer maximum of rainfall in addition to the regular winter maximum of marine climate; and (3) mountain climate with cloudy, rainy windward and dry leeward slopes, and strong winds caused by irregular heating and cooling. The Japan current has little effect except in a very general way by causing slightly higher temperatures to prevail in the whole northern Pacific Ocean.

THE WATER RESOURCES OF WASHINGTON

By Henry Landes

State Geologist, University of Washington

PRECIPITATION

THE State of Washington is located in the path of the prevailing westerly winds. Since these blow off the Pacific Ocean, at temperatures conducive to ready evaporation, it is not surprising that they are generally high in humidity when they reach our western shore. In crossing the state they pass over a great variety of topography so that belts of fog, rain, snow, and sunshine are commonly produced. The zones or belts of fog and rain are common to the western slopes of the mountains and the areas of snow-fall to their summits; while at the eastern bases of the highland masses the air clears and sunshine is the rule.

STORAGE

In order to receive the greatest benefit from the normal precipitation of a region natural means of storage must be convenient. Precipitation is generally seasonal or irregular and hence any method of storage at hand will assist in preventing floods and make the run-off of the streams much more regular. In regions of moderate rainfall it is of great value to a country to be served by streams that are active all the year.

Proceeding from within outward we find the chief reservoirs or storage facilities in the rocks, soils, lakes and swamps, snowfields and glaciers. It is a well known fact that sedimentary rocks in general hold more ground water than igneous and metamorphic rocks. Of sedimentary rocks sandstone has the largest pore space and hence is the most frequent container of water stored in the bed-rock. In Washington igneous and metamorphic rocks predominate and sedimentary rocks underlie only a minor portion of the state. East of the summit line of the Cascades sedimentary areas are relatively small and disconnected. They are composed mainly of sandstones and shales of lacustrine origin and of Tertiary age. West of the Cascades sedimentary rocks occur over considerable areas in the foot-hills of those mountains, as a narrow fringe around the Olympics, and in larger areas in the southwestern counties facing the lower Columbia and the ocean. The main western slope of the Cascades is composed of metamorphic rocks with igneous flows and intrusions; the core of the Olympics is a mass of closely folded metamorphics; and basalts alternate in outcrop with sandstones and shales in southwestern Washington.

From the above statement it will be seen that the bed-rock of the state as a whole is not favorable for the maximum storage of water. The only localities where it is necessary to draw upon the bed-rock for water supplies is in the more arid portions of eastern Washington where surface storage is in-

sufficient to meet the needs of the people. In the Yakima Valley, where beds of sandstone and shale have been locally folded into synclinal basins, flowing wells are obtained which are used for domestic supply as well as for irrigation. Throughout the extensive basalt plains of south-eastern Washington, embracing almost one-third of the state, with an annual rainfall from five to twenty inches, wells of excellent water are obtained at depths varying from 100 to 500 feet. In penetrating the basalt the water is found sometimes in the very porous layers where an abundance of steam-holes characterize the rock, and at other times from the strata of sand and gravel that are sandwiched between two successive flows of lava.

The mantle of soil in Washington is very general, the principal exception being the precipitous mountains from which the disintegrated rock is swept away as rapidly as it is formed. Over large areas of the state the soil is abnormally thick. That is particularly true of the extensive areas of eolian soils in the south-eastern part of the state and of the glacial deposits about Puget Sound. On the whole the soil covering is a great reservoir for water storage, except where desert conditions prevail or where the soil is too thin to serve as a sponge. The unusual amount of water retained in the soil is demonstrated by the innumerable springs which are characteristic of the state. The varying amount of water contained in the soil is reflected very generally by the character of the vegetation in any locality. Where forests grow an intimate relation exists between the kinds or families of trees which predominate over any area and the amount of water stored up in the soil beneath.

Lakes and marshes abound throughout the glaciated portions of the state as well as on the flood plains of the larger rivers. Their total area is large and they are important reservoirs that equalize the flow of the streams. The high mountain lakes are usually in cirques or behind dams of morainal origin. The largest lake in the state, Lake Chelan, is essentially of the same origin as a fiord, in that the long continued rasping of a glacier has worn down the floor of a sinuous and narrow trough until it eventually produced a lake with a maximum depth of 1500 feet. Some of the mountain lakes are due to volcanic action, either where lakes now occupy former craters, or where a lava flow has crossed a main valley at right angles and served as a dam to impound the waters. Many of the lakes in east-central Washington owe their origin to the action of the winds in carrying fine soil and depositing it across the channels of streams at a more rapid rate than the running water could remove the obstructions. Moses Lake has been formed behind a belt of traveling sand dunes which are slowly moving from west to east. Lake Washington, near Seattle was once an arm of Puget Sound, but was severed from it by the building of a delta, followed by a slight elevation above sea-level.

In an unusual degree the snow-fields and glaciers of the state serve as important reservoirs. The snowfall of the higher mountains, especially the Cascades, is excessive. Over hundreds of square miles the ground is bare only

for a month or so in the late summer. The glaciers represent masses of snow and ice of large storage capacity. The five large volcanoes of the Cascades are the centers of radiating systems of glaciers. The crest of that range, especially to the northward, is capped by a chain of glaciers over 300 in number. In the Olympics there are about 50 glaciers, as well as extensive snow-fields. The streams which head in the snow-fields, and especially the glaciers, are characterized by a uniformity of flow, and particularly by a strong summer flow when other streams are at their lowest ebb or have failed entirely.

The Drainage of Washington is discussed on page 314.

RUN-OFF

There is a great variation in the run-off of the streams of the state, not only geographically but seasonally. In the regions of least rainfall intermittent streams are the rule, but in the localities of maximum precipitation they are extremely rare, being confined to the smallest head-waters. Throughout western Washington, numerous live streams are abundant. It is only in the lower plateau or plains portion of the eastern part of the state that active streams are limited in number, and where they sometimes do not occur over considerable areas.

Because of seasonal influences there is much variability in run-off in all the streams of the state. In western Washington the rivers have a minimum flow in August and September because of the slight rainfall of those months. There is an exception to this statement in the case of rivers which head in large snow-fields or among important glaciers. Under such circumstances a uniformity of run-off is secured because of a more rapid melting of the snow and ice during the warm summer months. In western Washington, whenever the snowfall is unusual, the run-off in the late autumn and early spring may cause notable floods. If there has been an early snowfall of considerable depth "November floods" are usually expected. If the snowfall of midwinter is excessive the streams are likely to be swollen when the rapid melting of March and April takes place.

In the arid and semi-arid areas the majority of the streams are active only during the months of spring and early summer. Over much of this region the precipitation is mainly in the form of snow. If the ground be not frozen, and the snow melts slowly, the water may enter the ground, reappear in part as springs, and give a small but rather steady run-off to the streams. If the ground be frozen, and the warmth of spring comes quite rapidly, the snow will melt so quickly that floods along the larger stream courses are inevitable. Such floods are usually of short duration, but they may be quite disastrous when at their maximum.

SUMMARY OF DISCHARGE RECORDS OF CERTAIN RIVERS OF WASHINGTON

River and Locality	Years Observed	Drainage area in sq. miles	Discharge in second-feet		Mean	Mean per sq. mile	Run-off	
			Maximum Day	Minimum Day			Depth in inches on drainage area	Yearly average in acre-feet
Columbia—The Dalles	35	237,000	1,160,000	41,900	216,000	.91	12.22	139,000,000
Snake—Mouth	3	109,000	289,000	14,000	65,200	.59	8.11	47,200,000
Pend Oreille—Newport	8	24,000	155,000	5,700	26,100	1.09	14.79	17,500,000
Skagit—Sedro Woolley	6	2,930	96,100	3,250	15,000	5.11	69.20	10,900,000
Spokane—Spokane	22	4,000	35,200	1,240	8,330	2.08	28.24	6,040,000
Yakima—N. Yakima	17	3,550	19,800	765	4,750	1.34	18.16	3,440,000
Wenatchee—Cashmere	7	1,250	21,400	650	3,770	3.01	40.92	2,730,000
Snoqualmie—Snoqualmie	3	344	13,900	570	2,660	7.72	104.98	1,860,000
Chelan—Mouth	10	950	9,810	245	2,330	2.45	33.36	1,690,000
Baker—Mouth	4	270	17,400	634	2,300	8.16	111.00	1,670,000
Methow—Pateros	10	1,710	14,800	264	1,790	1.04	14.16	1,300,000
White—Buckley	5	424	14,600	390	1,580	3.73	50.64	1,150,000
Cedar—Ravensdale	12	149	13,600	110	681	4.57	62.05	493,000
Puyallup—Electron	5	91	3,200	120	477	5.24	71.25	346,000

The foregoing summary (p. 326) of discharge records of some of the larger streams of the state was compiled in the Tacoma office of the United States Geological Survey, from stream-measurements made during a series of years. The run-off of the various streams, as indicated in the column headed "depth in inches on drainage area," shows a wide diversity. The minimum is the case of the Snake, which comes from a region of low rain-fall and high evaporation, and the maximum is found in Baker River, which drains a large part of the great snow-fields and glaciers of Mount Baker, a locality of excessive precipitation and little evaporation.

QUALITY OF WATER

In the wells, springs, fresh-water lakes, and streams of the state the water has a high degree of purity. In chemical analyses that have been made of water from the rivers the low mineral content is conspicuous. In a series of analyses made by Van Winkle* he found that "the muddiest and the most strongly concentrated water, that of Snake River near its mouth, after the stream has traversed an arid plain, contains only 131 parts per million of dissolved and 52 parts of suspended matter." Van Winkle also found that the drainage of the Cascades and Olympics, as shown by analyses of water from various rivers, "carries less than 90 parts per million of dissolved solids and several mountain streams frequently carry as little as 50 parts." Except for the glacial streams the waters of the rivers are very clear, with a minimum of matter in suspension, and the proportion of dissolved matter is far below the average.

In some of the more sluggish streams of western Washington, where the vegetation is luxuriant, a perceptible amount of organic matter may be noted in the water, especially when the water has been retained in swamps or shallow lakes for some time. In eastern Washington, where there are a few lakes without surface outlets, the waters have become charged with certain soluble salts. The best known lake of this character, Soap Lake, near Ephrata, contains in solids 28 parts per thousand, mainly sodium carbonate, with smaller amounts of sodium sulphate and sodium chloride.

UTILIZATION

Water for Domestic Use.—It goes without saying that the highest use of water is that for domestic purposes. In the humid portions of the state excellent water in abundance is readily obtained for house use, from wells, springs, or streams. It is only in the most arid localities that any trouble is experienced in securing an ample water supply. Even here good water may be had from occasional springs or from deep wells. Since wells having a depth of several hundred feet, sunk in hard rock, are expensive, it occasionally happens that the homesteader or "dry farmer" will secure the necessary water for his house and barn by hauling it some distance in a large tank.

*Van Winkle, Walton. *Quality of the Surface Waters of Washington*. United States Geological Survey. Water-Supply Paper 339, p. 93-1914.

The cities and larger towns of the state are all fortunate in obtaining large supplies of pure water with the minimum of expense. It is the rule for the municipalities to own their own waterworks. Those that are located conveniently for that purpose obtain their supplies from the mountain streams, and provide an intake for the water mains that is beyond any likelihood of contamination. Natural lakes are sometimes used for storage, and when these are not at hand artificial reservoirs are provided. Nearly all the towns of the state secure their water supplies from streams and lakes, except in the regions of low rain-fall where most of the water courses are intermittent in character. In such instances deep wells are driven into the bed-rock, usually basalt, and the water then pumped into storage basins from which it may be distributed by gravity.

Irrigation.—The second use for the water supply of the state, in order of importance, is for the purpose of irrigation. In the interior basin, along the Columbia, Snake, Yakima, Wenatchee, Methow, Okanogan, and other streams, below the 1500-foot contour, the natural rainfall is rarely sufficient to grow a crop. This means that irrigation must be practiced over several thousand square miles of arid country if agriculture in any form can be successful. As a rule the soils of the desert are deep and of good quality. With water readily obtained, under gravity, it is not surprising that irrigation is now of prime importance in our economic development. Under cultivation at the present time, and in projects under way or definitely contemplated, almost a million acres of arid land are involved. Since the levels of water in the Columbia and Snake are so low with respect to the adjacent country these streams are drawn upon for irrigation only in a very limited way, and then by pumping. The streams from the mountains bring the water that is most used for irrigation, because only gravity methods of distribution need then be employed.

More than half of the 500,000 acres of irrigated land of the state is located in the Yakima Valley, the water coming from that stream and its tributaries. Storage facilities in the way of both natural and artificial reservoirs may readily be provided so that the entire run-off of the river system can be used for irrigation. By referring to the foregoing table of discharge records it will be seen that the yearly average run-off of the Yakima River amounts to 3,440,000 acre-feet. If we assume the duty of water to be from three to three and one-half feet per acre it will be seen that if all the water of the Yakima could be stored and utilized it would irrigate one million acres of land. It may be stated conservatively that a perpetual water right in that locality is worth not less than seventy-five dollars per acre. It is not difficult to see from these figures that the value of the water of this one river for irrigation alone is not far from seventy-five millions of dollars.

While the average rainfall in all parts of western Washington is ample for all kinds of agriculture, the drouth that usually prevails in July and August causes some severe limitation in the length of the growing season. It is recognized that even in the humid belt irrigation would be very desirable when the

rains fail in the summer and when evaporation removes the last moisture from the soil. At several places, on a small scale, irrigation has been begun in western Washington, and without doubt it will lead to a very general practice.

Water Power.—The third great utility of water is for power. It is evident that in a state where the precipitation is so heavy over large areas, and where in short distances the streams make rapid descents from high mountains to the sea, water power should be very abundant. In a report of the Commissioner of Corporations on Water-Power Development in the United States, under date of March 14, 1912, the minimum potential power of the whole country, calculated at 75 per cent efficiency, without storage, amounts to 26,736,000 H.P. In the same series of calculations the estimated horse-power of the Pacific Coast states is as follows: Washington, 4,932,000; Oregon, 3,148,000; and California, 3,424,000. It is thus shown that on the Pacific border nearly one-half the water-power of the United States is to be found and of this amount more than one-third is in Washington. It is apparent that in a state like this, where storage facilities may usually be provided at a cost that is not excessive, the possible amount of power may be greatly increased over the above estimates. A contributing agent of great value to the water-power possibilities of the state is the fact that so many of the rivers head in great snow-fields and glaciers, whereby the flow of the streams in the months without rainfall may be kept constantly at a high mark by the rapid melting of the ice and snow.

A careful study and estimate of the available water-power of the state is being made by the United States Geological Survey and the State Geological Survey, under a scheme of cooperation. The field-work for the Cascades has been almost completed and three of the seven reports have been printed. They are known as "Water Powers of the Cascade Range," Parts I, II, and III and have been issued as Water Supply Papers 253, 313, and 369. In these reports which cover the southern half of the Cascades, but including less than half the water-power of that range, the horse-power for the chief streams may be tabulated as follows:

<i>Stream</i>	HORSE-POWER	
	<i>Minimum flow</i>	<i>With storage</i>
Klickitat	154,000	154,000
White Salmon	105,000	105,000
Little White Salmon	5,500	5,500
Lewis	78,000	78,000
Toutle	44,000	44,000
Cowlitz	105,000	175,000
Nisqually	27,700	35,700
Puyallup	36,800	40,400
White	57,400	102,000
Cedar	5,400	37,900
Yakima	74,700	132,000
Total	693,500	909,500

In the surveys of the first five streams in the above table the amount of storage was not determined and hence the estimates in that column are the same as under minimum flow. It should also be pointed out that in the case of the Yakima there will be available during the irrigation season a total of 287,000 horsepower.

In the entire state hydro-electric plants with a total capacity of about 400,000 horsepower have been developed. It is evident that Washington has more water-power than will be utilized for many generations. New units are placed in commission as the population increases and there is a sale for the power. Today the water-powers of the state supply practically all the electric energy used in municipal lighting, street and suburban railways, and in driving a large portion of the machinery used in the varied manufacturing enterprises.

Logging and Navigation.—The use of streams for logging is important in the sections of the state. This affords not only a means for cheap transportation but storage facilities are frequently provided in the streams near their mouths where the logs may be kept in good condition until they are cut in the mills. Navigation is of minor consequence despite the fact that the rivers are numerous and carry large volumes of water. This is mainly true because of the general velocity of the currents and the frequent occurrence of rapids, cascades and water-falls. By the use of locks at two points the Columbia, although relatively rapid, has been made navigable from its mouth to the foot of Priest Rapids, a distance of about 400 miles. The stretch of river from Wenatchee to the mouth of the Okanogan has been navigated for a number of years; and small freight boats make frequent trips on the upper river from the mouth of the Okanogan to Kettle Falls. By the removal of certain obstructions near its mouth Snake River has been opened for passage throughout its course in Washington, but only boats of small size run above Clarkston. The Okanogan for some years, during the high water of early summer, has been navigated as far as Riverside. The Cowlitz has navigable water as far as Toledo; the Chehalis as far as Montesano; while small steamers have made occasional trips on the Skagit as far as Hamilton.

RELATION TO INDUSTRIAL LIFE

The water resources of the state now have, and always will have, intimate relations with the industrial life of the people. If we take the most fundamental of all occupations, that of agriculture, we find that precipitation is of primary importance in determining the kind and value of farm products. Already about the state we have come to recognize centers of cereal production—here wheat, there barley, somewhere else oats or perhaps corn. In fruit growing there are some areas best adapted for apples, others for grapes, and still others for peaches and apricots. The districts best adapted for forage crops are well known, and alfalfa, timothy, and clover have their recognized localities of peculiar advantage. In all these instances the governing factor has not been alone the total annual precipitation, but the kind of precipita-

tion, the relative amounts of rain and snow, the seasonal variation, and the accompanying conditions of cloud and sunshine.

In the forest the practical lumberman knows where to look for the best Douglas fir, or cedar, or hemlock, or spruce, or pine, or for whatsoever variety of tree that he desires. Among the men of the woods such expressions as "cedar swamps," "alder bottoms," "hemlock ridges," "fir uplands," "pine slopes," and many others are very common. In the distribution of the forest species the annual rain-fall is of paramount importance. But of almost equal significance is the depth of the soil and its varying ability to retain moisture, coupled with the amount of evaporation which depends so much upon the percentage of cloudiness and sunshine.

The business of manufacturing, more particularly in the future, will come to be inseparably connected with the water resources of the state. This will come mainly in the widespread utilization of the power to be had from the mountain streams. The highlands of Washington abound in opportunities for the development of comparatively small hydro-electric plants capable of driving all the machinery in their immediate localities. The larger installations will make possible the electrification of the railways, supply the necessary current for the light used in the cities and towns, and provide all the power that is needed in the industrial centers.

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THE FORESTS OF WASHINGTON

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OF a total land area of nearly 45,000,000 acres in the State of Washington, approximately 25,000,000 acres are covered with forests of merchantable timber. What the original stand was may never be known with any degree of accuracy. It is estimated that between 350,000,000,000 and 400,000,000,000 feet board measure remain. This represents almost one-eighth of the present stand in the entire United States, and has a value of almost 400,000,000 dollars in stumpage alone. Eighty-eight per cent of the standing timber occurs west of the Cascades, about eight per cent between the Cascades and the Columbia-Okanogan River valley, and four per cent east of this valley. About one-third of the timber is included in the National Forests of which there are eleven in the state, comprising a total area of about 10,000,000 acres, and nearly two-thirds is held by private timberland owners.

The crest of the Cascades makes a natural division line on either side of which the conditions of forest growth are quite different. The entire portion west of this line, including also Oregon and northern California, was originally covered with one solid forest. The mild climate, heavy rainfall, and generally humid atmospheric conditions have resulted in the production of a forest than which there is none more wonderful in the density of its growth and majesty of development in the entire world. In Washington and Oregon Douglas fir is the chief species. Trees 8 to 10 feet in diameter, towering 250 feet in height are not uncommon and it is not at all rare to find more than 150,000 feet of merchantable timber to the acre. The ground is densely covered with underbrush. East of the Cascades the climate is drier and marked by considerable extremes of temperature. This portion of the state consists largely of open prairie-like agricultural and grazing lands. Except for small isolated areas scattered here and there the forests are confined mainly to three regions, (1) the east slope of the Cascades including the foot-hills, (2) a belt 30 to 50 miles wide along the entire northern boundary of the state, and (3) an area, probably about 24 miles square, in the south eastern corner of the state. The principal species is western yellow pine. The trees are smaller

Note—What is said in this article concerning the forests and forest conditions of Washington will hold true so far as general principles are concerned for those of British Columbia and Oregon. The general forest conditions in Oregon and Washington are practically identical. The chief differences between the two states will be found in the amount of standing timber and the annual cut. Oregon has not as yet cut into her forests as heavily as Washington. According to the last census with a cut of nearly 2 billion feet she ranked 9th in point of production in the United States, whereas Washington ranked first. According to a report of Mr. H. R. MacMillan, Chief Forester of British Columbia, the entire forest production of the Northwest including British Columbia, Washington, Oregon and Idaho has an annual value of 200,000,000 dollars. He also states that 33 per cent of the public wealth of British Columbia, 42 per cent in Washington, 45 per cent in Oregon and 31 per cent in Idaho, is derived directly from the logging camps, sawmills and other forest occupations.

and slower growing and the forest itself more open and generally park-like in character than west of the mountains. Underbrush is usually absent but grass is abundant. The stand per acre will probably not average much over 12,000 feet.

The forests have furnished the chief raw materials upon which the early development of the state was built. Many of the cities and towns of the north-west coast owe their rapid development and their present importance more directly to the forests than to any one other natural condition. The industries of Portland, Seattle, Tacoma, Everett, Bellingham and the entire Grays Harbor and Coos Bay regions, to within comparatively recent times were more directly dependent upon the products of the forest than upon the products of fields, farms, fisheries and mines combined.

The following tables show the relative importance of these industries:

TABLE I

Value of Lumber and Timber Products Compared to Agriculture. (1910).*

Lumber and timber products.....	\$ 89,155,000
Wood-lot products	3,754,293
Total forest products	\$ 92,909,293
Grain	\$78,927,055
Domestic animals	10,249,346
Dairy products	8,746,041
Eggs	4,311,000
Orchard fruits	4,274,000
Garden truck	3,000,000
Small fruits	941,415
Total all agricultural products	\$110,448,855

TABLE II

Forest Products Compared to Other Manufactured Products

All manufacturing industries—value	\$220,746,000
Lumber and timber products	89,155,000
Value of forest products in percentage of total.....	40.4%
Annual wealth added to the state through lumber manufacture in percentage of total added wealth due to manufacture.....	50.8%

The above tables show without further comment the tremendous value of our lumber industry to the state. The importance of this is emphasized even more when it is known that about 80% of this total annual value of the lumber and timber products goes into general circulation among the people of the state for wages and supplies and that 63.3% of all the wage earners engaged in manufacturing in the state are employed in the lumber industry.

*All figure

to last census.

The Pacific Northwest in normal times furnishes a larger proportion of the lumber cut of the United States than any region of similar size.** Washington is the largest lumber producing state in the Union, and has held that position since it first took the lead in 1905.

Like all of the states traversed by mountain chains, Washington will always have a large proportion of land that will not be economically adapted to any purpose better than to the production of timber crops. It has been estimated that in the western part of the state perhaps 50% of the land will be permanent forest land.

This condition leads to an economic situation in the state that demands attention. It rests upon two conditions. The first is the present large economic value of the lumber industry, the other is the large area of land within the state that will be almost worthless unless it is made to produce timber crops. Without a sufficient lumber industry the wood crops that can be grown on the non-agricultural and the non-grazing lands will have no value and without the raw materials produced by continuous wood crops we can have no lumber industry of importance in the future. This does not mean that a curtailment in the production of lumber to husband our supply would be an advantageous thing. On the contrary much of the land covered with virgin forests is producing practically nothing now because the trees are over-mature and hence decay probably fully balances the new growth. If this old timber were gradually cut off and new growth established the land would again become increasingly productive. The problem can only be met by a proper encouragement of the use of wood and by provisions for reforestation under the direction of the state. This means state forests and a state department of forestry organized to carry on a system of forest management on the cut-over forest lands and a research department for the study of the utilization of forest products. Although Washington, like her sister states of the Northwest, has the conditions which should always make her one of the most important timber states of the Union she is doing far less than most other states to insure her future along these lines. Unless definite action on this question is taken soon, history will here repeat itself and we shall be confronted with the same economic conditions that arose in many of the timbered regions of the East where the problem had finally to be taken up with the expenditure of large sums of the public funds, and even then was only partially solved.

In the past the chief need in the care of the forests has been fire protection. During the dry season which occurs in July, August, and September, Washington has for many years past suffered severe losses through the burn-

**It is only fair to state that since the above figures were compiled the lumber industry has been passing through a decided period of depression and that the value of agricultural products of all kinds, but more especially of wheat, produced annually, as also the manufacturing industries other than lumber, have increased with marked rapidity. Yet all present indications are for an immediate increase in lumber production very considerably in excess of any quantities produced since last census.

ing of timber and the entire population has had to contend with the very disagreeable feature of having the sky clouded and the atmosphere tainted with smoke at the season which should be the most beautiful. A widespread campaign of education and organized effort and cooperation on the part of the National Forest Service, the State Forester and the Washington Forest Fire Association (comprising the timberland owners of the state) has led to a system which practically insures against the loss of timber from fires. The smoke nuisance caused by the necessity of burning slashings will however probably be with us for some years to come. Each of these institutions receives its support from a different source but the work of protection is so organized that all parties work together for the common end of protecting all the timber of the state. Although owners of something less than one-third of the acreage in private hands do not contribute to this system they nevertheless gain practically the full benefit, for in a system such as this must be in order to be effective, an unprotected area becomes a menace. During 1915 the timberland owners assessed themselves 2 cents per contributing acre and had a net operating cost of 1.78 cents per acre.

Douglas fir, also known as red fir, yellow fir and Oregon pine, is the chief species of the north-Pacific slope. Excepting the Sequoias (Big Trees) it is the most gigantic tree of the region. Under normally good conditions of growth it reaches a height of from 180 to 190 feet and a diameter of $3\frac{1}{2}$ to 6 feet. Such trees are usually between 300 and 400 years old. Under exceptional conditions trees over 250 feet in height and 8 to 10 feet in diameter are found and these trees often approach 500 years in age. This species alone composes about 25 per cent of the timber supply of the country and by far the greater part of it is located in Washington and Oregon. From the standpoint of its adaptability to forest management it is one of the best species known. It is easily reproduced and grows very rapidly. Studies made in second-growth stands show that in a period of 100 years on the best soil conditions it will yield nearly 80,000 feet to the acre without any special care other than fire protection. It has an annual growth of between 800 and 1,500 feet B. M. per acre per year.

From the standpoint of general usefulness it has practically no rival. Though there are other species that are better adapted to certain specified purposes, Douglas fir is being used for nearly all purposes where wood can be used. Owing to the large size of the trees they contain a large amount of clear lumber. The wood varies greatly in texture and color from a fairly soft, fine-grained, straw yellow to a hard, coarse-grained, red brown. This difference in condition has led to two distinct names among lumbermen, the term yellow fir being used for the former and red fir for the latter. Botanically they are, however, the same species. For use as large structural timbers, Douglas fir has no equal in that it is stronger than any other coniferous species and at the same time lighter than its nearest competitor, the long-leaf pine of the Gulf States.

The other important timber species of the state, in the order of their importance from the standpoint of annual cut are Sitka spruce, black cottonwood, western hemlock, western yellow pine, western red cedar, red alder, western white pine, Oregon maple, western birch and Oregon oak. All of these occur at the lower altitudes and with the exception of the western yellow and the white pines, they are found for the most part only west of the Cascades. The coniferous species also grow together in mixed stands or may be found in pure stands of varying extent consisting of only one species. The hardwood or broad-leaved species occur chiefly in small scattering stands in the river valleys. The western yellow pine is the principal tree east of the Cascades where it occurs largely in pure or nearly pure stands, and the white pine is found on both sides of the mountains.

Western red cedar is the source for the famous red cedar shingles, and western Washington produces from this species, 66.6% of all the shingles manufactured in the country. Western hemlock, although perhaps next in abundance to Douglas fir has not found general favor in the lumber market chiefly because of the bad reputation of the eastern species of the same name. The western species, however, has proven itself to be nearly as good as the Douglas fir for many uses and in time the public mind will be convinced that it has practically none of the bad qualities of the eastern hemlock. Spruce is used largely for wooden containers, and spruce and cottonwood are the chief sources of raw material for the production of wood pulp. Although our supply of broad-leaved or hardwood varieties is comparatively small, the state is able to meet its present demands for such wood.

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FISHERIES AND FISHERY PRODUCTS OF WASHINGTON

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THE State of Washington is fortunate in possessing an extended shore line and a large area of both salt and fresh inland waters. The climate is so mild and equable, and the other conditions are so varied and favorable, that the waters of the state furnish a most suitable environment for an abundant and diverse fauna and flora. The protected waters of the Puget Sound, Grays Harbor and Willapa Bay furnish excellent shelter for the large fleet of boats engaged in harvesting the products of the deep. Under such favorable conditions, it is not surprising that the commercial products obtained from the waters of Washington are worth, annually, many millions of dollars.

THE SALMON

The salmon are by far the most abundant and valuable of the fish found in the waters of the state. In fact, the salmon fisheries of the Pacific Coast of North America far exceed those of any other waters of the world. Washington lies right in the midst of this industry and probably reaps more from it in a commercial way than any other state or territory bordering on the Pacific Ocean.

There are five closely related species classified together under the generic name, *Oncorhynchus*. The largest and best known of the five species is the king or chinook salmon. It ranges along the coast from southern California to the Arctic Ocean, and down the Asiatic coast to China, but is taken in largest numbers in the Columbia River. This fish has an average weight of 22 to 23 pounds, with a maximum weight that is very much greater; individuals have been taken ranging from 70 to 100 pounds. Large numbers of these fish are used fresh by local consumers and large shipments are made in cold storage to eastern markets.

The sockeye or blueback salmon is much smaller than the king salmon, having an average weight of not more than 5 pounds and reaching a maximum of about 12. This fish has, in recent years, passed in commercial importance the king salmon and now furnishes the greater part of the canned salmon of the world. Because of the deep enduring color and firm texture of its flesh it is considered more desirable as a canned product than the other salmon which do not possess both of these qualities. The most important sockeye river is the Fraser of British Columbia. During the spawning season they enter this river in incredible numbers. On their journey from their feeding banks in the ocean to the spawning grounds in the Fraser River, they pass through the northern waters of Puget Sound lying within the borders of the State of Washington, thus affording an opportunity to American fishermen to take them in large numbers. This fish is taken in still greater num-

bers in the waters of northern British Columbia and southeastern Alaska. In the latter territory it goes by the name of red salmon.

The silver or coho salmon has an average weight of about 6 pounds and reaches a maximum of 30. This species is abundant in the waters of Washington. Because of its pale color, it is not much in demand as a canned product, although it has a flavor little if at all inferior to that of the sockeye.

The humpback or pink salmon is the smallest of the five species, having an average weight of about 4 pounds and a maximum of about 11. It runs in large numbers in the Puget Sound every second year and in lesser numbers on alternate years. It appears in southeastern Alaska in much larger numbers than anywhere else. Its flesh is pink and not so firm as that of the sockeye salmon; nevertheless it is an excellent food fish and but little inferior to the sockeye.

The chum or dog salmon averages about 8 pounds in weight. It is not so highly prized for canning because of its pale color and mushy texture, but is valuable for salting and smoking. It enters many of the coastal streams of Washington to spawn.

The steelhead trout is not a salmon, but, because it is considered as such by many people, it is here treated in connection with the salmon. The steelhead is a very important fish commercially and much sought after as an article of fresh food. It is a large fish averaging about 12 pounds and reaching a maximum of 45 pounds.

HABITS OF THE SALMON

The salmon make their home in the salt water, coming into fresh water only at the spawning season. The length of life varies in the different species. Stated in general terms, the king salmon lives four years, although many live five or six or even more years, the sockeye and the dog salmon live four years, the silver salmon three or four, and the humpback two years. At maturity they seek the fresh water in vast numbers for the purpose of spawning. From the time they start for the fresh water until the time of their death which follows shortly after spawning, they take no food, although it may require many weeks to reach the spawning grounds. They seek, as a suitable place for depositing their eggs, the gravelly bottoms of the shallow upper streams. After spawning they swim or float about aimlessly in an exhausted condition until they die.

The steelhead, like the salmon, seeks the fresh water in which to spawn, but unlike the salmon it returns to the salt water where it completely recovers from the effects of the arduous journey to the spawning grounds and later seeks the fresh water to spawn again.

FISHING METHODS

A variety of methods are used in catching salmon. The oldest and one of the most popular equipments with the fishermen of the coast is the gill

net. This net is constructed with meshes of such a size that the fish can easily get their heads through but not their bodies. When they find it impossible to pass through the net they try to back out of it and in so doing the twine slips inside the gill covers and they are caught. These nets are used in and at the mouths of rivers and in channels where the fish run in large numbers. They are either anchored in place and left for a time or they are floated down the stream attended and directed by the fishermen in charge.

On the Columbia River the beach seine is used very extensively. The net, which is several hundred feet in length, is piled in the stern of a boat. One end of the net is made fast to the shore and as the boat sweeps out into the river the net is paid out. The boat makes as wide a semicircle as the length of the net will permit and after the net is all out horses are used to haul it to shore as quickly as possible. In this way many fish are caught.

The most efficient method of taking fish in the more open waters is by the use of the purse-seine nets. These nets are 1500 to 1800 feet long and 80 to 100 feet wide and are operated from the sterns of power boats. These boats are 40 to 60 feet in length and propelled by gas engines of 25 to 60 horse power. On arriving at the fishing grounds an eager look-out is kept until the school of fish is sighted; then a large row-boat which is towed astern is released and the seine which is made fast to this boat is paid out from the large boat while it makes a circle of as great a diameter as the length of the net will permit. When the circle is completed, both ends of the pursing rope, which passes loosely through rings in the bottom of the net, are hauled in by a winch worked by the engine until the bottom of the net is completely closed. Then the net is hauled aboard until but a small part of it, in which are enclosed the fish, is left in the water. The fish are then brailed out into the hold of the boat and the operation is ready to be carried out again. There is a fleet of about 400 of these boats on Puget Sound, each of which is manned by 7 or 8 men and valued, with its equipment, at \$4,000 to \$7,000.

Another very efficient method of taking fish is by means of traps set in the shallower waters near shores where the fish run in large numbers. The trap consists of a lead not more than 2500 feet in length consisting of wire netting fastened to piles driven firmly in the ground. The netting reaches from the surface of the water at high tide to the bottom. At one end of this lead is a peculiarly formed trap consisting of several parts the last of which is a large square bag made of heavy netting known as a spiller. The fish follow the lead which directs them into the trap and finally they find their way into the spiller from which they cannot escape. The fishermen lift the spiller and remove the fish, as a rule, daily. Record catches of 40,000 to 50,000 fish have been taken at a single lift of the spiller.

Another interesting device for taking fish, used principally on the Columbia River, is the fish wheel. These wheels average about 24 feet in diameter, and ten feet in width. At the circumference of each wheel are fixed large scoops made of wire netting and shaped like dip nets. These wheels are

placed near the shore in water through which the fish pass in large numbers up stream. The current of the river turns the wheels and the fish that are taken in the scoops are carried up and dumped into chutes along which they slide into large boxes on shore.

Trolling is another common method of taking the salmon. Small power boats are used for this purpose. Usually three lines with spoons or baited hooks are drawn along behind the boat. This method combines sport with business but the sport is soon lost sight of in the business. Large numbers of king and silver salmon are taken by this method.

There are a number of other methods used in taking salmon but they are of minor importance when compared with those already described.

SALMON FISHERIES AND CANNERIES

Because of the great commercial value of the salmon, much capital is invested in appliances for taking the fish and in equipment for preserving and canning them.

The report of the State Fish Commissioner for 1913 shows that more than \$12,000,000 was used to capitalize the industry in the state of Washington. Nearly 9,000 men were employed for the season. The total number of salmon caught by all methods in the state of Washington for that year was 41,439,441 which yielded a total of over \$15,500,000. The total salmon products for the year from the entire Pacific Coast were valued at over \$42,000,000. This is the greatest output in any one year in the history of the industry on the Pacific Coast. These large results are due to the big run of sockeye to the Fraser River, and the fact that the fishing interests were much better equipped for taking and canning the fish than ever before.

The season of active operation for the canneries of Puget Sound is very short. They usually start to can fish during the latter half of July and by the middle of September the canning for the season is practically over. On the Columbia River and other parts of the coast the season may be longer, but in every case the season and length of time the canneries are operated depends on the run of the fish to the spawning beds.

FISH PROPAGATION

Owing to the increasing demand for salmon and consequently the large increase in the number taken it has been felt that unless some efficient means were taken to conserve this industry it would soon be ruined and the state would lose one of its most important resources.

Nature's method of keeping up the supply of fish is very wasteful. At the time of spawning a large per cent of the eggs are eaten by other fish living in the streams, many are buried so deeply under the deposits brought down by the streams that they are destroyed, and, again after the young are hatched, owing to their bright, attractive color and their helplessness, large numbers of them become victims to their ravenous enemies, so that but a small percentage of

the eggs spawned develop into fish that reach the ocean. Moreover the settlement of people along the water courses of the state help to render the natural propagation of the fish more precarious.

In order to preserve, if possible, this important source of food supply, both the United States and the state, through their fish commissions have undertaken by artificial means to propagate the salmon in large numbers. Together they have over 40 hatcheries scattered over the state in which more than 100,000,000 eggs are annually taken and cared for. After the young fish are able to take food they are placed in ponds and fed for a considerable time. When they are turned into the streams, it is believed they are able to take care of themselves much better than if they had been turned free at the time of complete yolk-absorption. By this means over 80 young fish are turned out for every 100 eggs taken and it is believed that a very large percentage of those released will find their way to the ocean.

OTHER FISHERIES OF THE STATE

Halibut.—The fish next in commercial importance to the salmon is the halibut. Formerly this fish was found in abundance on the banks of the Washington and Vancouver Island coasts, but in recent years these areas have been practically exhausted, so that halibut fishermen have been driven to the banks lying between the north end of Vancouver Island and Alaska where the fish are found in abundance.

A fleet of 100 halibut vessels are owned and have their headquarters in Puget Sound. Out of a total catch of over 66,000,000 pounds for 1915, more than 33,000,000 pounds were handled in Seattle. Because this fish is prized so highly as a fresh food product the bulk of the catch is packed in ice and shipped to eastern markets where it is in great demand.

The cod-fish industry is as yet in its infancy and only a few men and vessels are engaged in it. Of the 25 vessels used in taking and carrying the fish 8 belong to Puget Sound. The fish are taken in Alaskan waters and handled through the various ports of the coast.

Herring are taken in large numbers in Puget Sound during the spring months but almost the entire catch is used as bait for the halibut fisheries.

Smelt and chad are taken in considerable numbers in the waters of the state. The smelt is native but the chad has been introduced into the Pacific waters from the Atlantic. The chad promises to become very abundant.

BY-PRODUCTS OF THE FISHERIES

Formerly thousands of tons of offal were dumped each year from the canneries and fish concerns into Puget Sound, polluting the waters and destroying life. Now all this material, together with fish not considered good for food as dog fish, skates, and sharks, is used in the manufacturing of oils, glue, and fertilizer.

SHELL-FISH

The oyster is by far the most important of the shell-fish found in the waters of the state. Extensive oyster beds are located in Willapa Bay, Grays Harbor and Puget Sound. According to the report of the State Fish Commissioner there are more than 14,000 acres of oyster lands in the state reserves, added to this are some thousands of acres in the hands of private individuals.

In the earlier years of the industry, the oystermen depended entirely on the natural resources of these beds. After a time they found that the beds were being so completely depleted that it was no longer profitable to work them. After a number of experiments that were but partially successful they evolved the method now in use, which has resulted in making the beds highly productive. By this method many areas of tide lands varying from one-half to sixteen acres in size were surrounded by substantial walls of reinforced concrete which were able to retain enough water to keep the beds covered while the tide was out. The enclosed areas were made practically level and then covered thickly with oyster shells or other debris of a similar character which served as attaching surfaces for the young oysters. After these beds are seeded down it takes three or four years for the young oysters to grow to a marketable size. Hundreds of acres are now under this form of cultivation and the results are highly satisfactory. Lands thus prepared are valued at upwards of \$2,000 per acre. Partly due to the diminishing returns from the native oyster beds and partly to the desire to introduce into local waters a most important resource, the eastern oysters were some years ago introduced. The young of the eastern oyster's were shipped by the car load and distributed over the beds of the state where they developed into as fine a product as can be found in the east. The one drawback is the failure of the eastern oyster to reproduce in the colder waters of the West, thus necessitating the continued shipment of the young from the East. In recent years, the fact has come to light that the eastern oysters are reproducing in Willapa Bay and that the results are all that could be desired. Experiments will be made to determine whether or not the oysters now reproducing in Willapa Bay will reproduce in the other waters of the state.

Clams, crabs and shrimps form an important part of the shell-fish industry of the state. There are a number of canneries on the coast and on Puget Sound engaged in canning clams. The entire output of shell-fish for 1915 was valued at nearly \$600,000.

Attempts are being made by the United States Fish Commission to introduce into the waters of Washington the lobster of the Atlantic coast. Large shipments of them have been planted in the Puget Sound waters, around San Juan Islands, but it is too early to predict what the outcome will be.

MINERAL RESOURCES OF WASHINGTON

By Charles E. Weaver

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THE rocks occurring at the surface in the state of Washington are extremely varied. Those forming the Cascade Mountains and the Okanogan Highlands are in part the result of the cooling and consolidation of liquid rock deep beneath the earth's surface and in part the result of the baking or metamorphosing of sandstones, shales, and limestones. Such conditions have rendered it possible for the development of metaliferous mineral deposits such as gold, silver, copper, zinc, antimony, molybdenum, tungsten, chromium, etc.

The Columbia Basalt Plateau of eastern Washington is largely composed of nearly horizontal layers of basaltic lava flows with interbedded layers of sandstone and shale. Mantled over these formations are gravels and sands which were formed by glaciers and former rivers. In places these lavas attain a total maximum thickness of five thousand feet. They are the result of the cooling and consolidation of liquid rock which came up through numerous fissures and veins in the earth's crust from molten reservoirs existing below, and flowed out over it. Such conditions are as a rule not conducive to the development of metaliferous mineral deposits. Such basalts do however constitute a valuable source of material for road building purposes. They occur in the Puget Sound Basin and in the lava plateaus of Washington.

COAL

With the exception of the Olympic Mountains and the San Juan Islands the low hills of western Washington are composed of alternating layers of shales, sandstones, conglomerates, and lava flows. These were in part formed in lakes and in part in former embayments of the ocean which at times covered much of this area. During that epoch climatic conditions were much warmer than today and vast forests of tropical plants were growing on the land areas and in the swamps. From time to time the land areas were slowly being elevated and depressed with respect to the shore lines. As a result the tropical forests consisting of palms, figs, etc., were buried and covered with sands and muds. Ultimately the plant remains were converted into coal and the original interbedded horizontal layers of sandstone, shale, and coal were differentially subjected to pressure from below and folded, squeezed and in places rent asunder by faults. At the present time these rocks are largely covered with gravels and sands of glacial origin. The coal deposits which were formed in this manner vary greatly in general character and quantity. Some beds are of commercial importance and are being mined at the present time. Coal deposits of economic importance occur in Kittitas, King, Pierce, Whatcom, Thurston, and Lewis counties. The coal ranges in character from a bituminous to a lignite grade. The higher grade coals are being mined

at the present time in King, Pierce, and Kittitas counties and are marketed in both eastern and western Washington. Coal constitutes a considerable portion of the commercial mineral wealth of the state.

The following table includes the yearly production and valuation by counties of the coal mined during the period from 1910 to 1912:

Value of Coal Mined

	1910	1911	1912
	Tons	Tons	Tons
Kittitas	1,661,650	1,256,745	1,237,427
King	1,242,340	1,259,521	1,063,110
Pierce	786,096	783,196	788,293
Lewis	179,484	172,734	128,377
Other Counties	42,329	100,619	143,725
Total tons	3,911,999	3,572,815	3,360,932
Total value	\$9,764,465	\$8,174,170	\$8,042,871
Average price per ton.....	\$2.50	\$2.29	\$2.39

GOLD, SILVER, AND COPPER

Gold and silver ores occur in the Cascade Mountains and in the Okanogan Highlands. They are being mined in several districts in Stevens, Ferry, and Okanogan counties. While there are market variations in the quantities and values of these ores, yet the geological occurrence does not greatly differ. The prevailing country rock is a green colored schist together with crystalline limestone, slate, and granite. All of these rocks are cut by numerous dikes. The gold and silver deposits usually occur in quartz veins. These veins vary greatly in thickness as well as in the value of the gold and silver content. Some veins when assayed yield only ten or fifteen cents in gold and silver to the ton of quartz while others may locally contain several hundred dollars to the ton. Usually those veins which do not contain more than two or three dollars of gold to the ton cannot be mined on a commercial scale. The average values of the gold and silver ores which are mined in this region probably range from two to ten dollars to the ton. Often such ores contain varying amounts of copper, zinc, lead, antimony, or arsenic. When these minerals are present they may add to the total value of the ore. Under such conditions quartz veins containing less than two or three dollars to the ton of rock might be commercially mined.

When quartz veins contain only gold and silver the rock is usually treated at the mine in a stamp mill where it is crushed to a fine powder, mixed with water and allowed to pass over plates covered with mercury. Whatever gold may be present in the powdered rock collects on these plates. The rock flour is carried off as a slime, and later the gold is recovered from the mercury. In order to mine such veins on a commercial basis the value of the gold which can be recovered from the rock must be greater than the cost of min-

ing the ore and extracting the gold in the mill. If commercial quantities of copper, lead, zinc, etc., are present the ores are usually shipped by railroad or wagon to some nearby smelter where they are roasted and treated by various methods to recover the mineral content. In neither case is it usually possible to recover all of the gold or other metal within the quartz.

Gold mining camps occur in several portions of the middle and northern Cascades. Certain districts which were formerly active are now performing only yearly assessment work in order to hold the mineral claims. Among the more important of these are Orient in Stevens County; Blewett in Chelan County, and Monte Cristo in Snohomish County. The most active gold producing district during the last few years is that around Republic in Ferry County. Copper deposits of small extent occur at several localities in the Cascades as well as in the Okanogan Highlands. The value of copper ores depends largely upon the copper bearing minerals forming the ores. Some minerals contain as low as 20 per cent copper while other minerals contain 80 per cent. The proportion of copper minerals to quartz in the veins varies considerably. Usually if the per cent of copper in the vein rock is less than one per cent the ore cannot be commercially mined. If the ore happens to be very rich in copper and the ore body small the same holds true. The copper deposits of Washington are small as compared with the great producing districts of Montana, Lake Superior, and Arizona. When the price of copper is high many of the mines in Washington can be worked on a commercial basis. When the price is low the majority of the camps become inactive. In 1900 they were nearly all active. During the past twelve years the copper districts of Washington have been characterized by their inactivity. Because of the present high price of copper many abandoned mines are being reopened. The more important copper camps are situated in Stevens, King, and Snohomish counties. The following table includes the yearly and total production of gold, silver, copper, and lead by counties from 1905 to 1912:

Value of Gold, Silver, Copper and Lead

County	1903	1905	1910	1912	Total 1903-1912
Ferry	\$368,861	\$107,160	\$814,913	\$ 712,250	\$3,172,634
Stevens	75,412	212,523	106,319	339,347	1,352,640
Snohomish	139,305	72,747	105	721	362,027
Whatcom	48,418	91,338	26	2,201	338,972
Okanogan	71,917	8,779	14,894	18,220	184,129
Chelan	80,080	13,010	6,941	30,636	182,055
King	1,604	19,494	21,887	9,419	104,970
Total	\$785,597	\$525,051	\$965,085	\$1,117,794	\$5,697,427

LIMESTONES

Deposits of crystalline and dolomitic limestone occur in the central and northern Cascades, in the San Juan Islands and in the Okanogan Highlands. They are interbedded with quartzites and slates of Carboniferous or Mesozoic age. Some of the deposits are being used in the manufacture of lime and Portland cement. One of the largest lime producing plants is situated at tide water on the north end of San Juan Island at Roche Harbor. Cement plants are located at Concrete in Skagit County, at Bellingham in Whatcom County and at Metalline Falls in Pend Oreille County.

CLAYS

Clay deposits of varying grade are widely scattered through the state. They are the result of residual rock decay as well as deposits of marine, brackish water, and lacustrine sedimentation. Several plants are in operation in both eastern and western Washington. The clays are utilized in the manufacture of tile, brick, pottery, and terra cotta. The following table gives a list of the locations of the plants as well as the products of the clays of the state.*

Location of Clay-Working Plants

(2) or (3) signify number of plants.

Brick and Tile

City	County
Chelan	Chelan
Taylor	King
Seattle	King
Chehalis	Lewis
Baker	Skagit

Sewer Pipe

Kummer	King
Mica (2)	Spokane
Chester	Spokane
Freeman	Spokane

Stoneware

Auburn	King
Clayton (2)	Stevens
Palouse (2)	Whitman

Paving Brick

Renton	King
Taylor	King

Terra Cotta

LaGrande	Pierce
Clayton (2)	Stevens

*From report on the Mineral Resources of Washington with Statistics for 1912 by Henry Landes, Washington Geological Survey, Bulletin No. 11, 1914.

Flint Fire Clay

Kummer (3) King

Portland Cement Clay

Bellingham Whatcom

Concrete Skagit

BUILDING STONE AND ROAD MATERIALS

Many of the sandstones and granites of Washington are used for building purposes. Sandstone quarries are operated near Bellingham at Tenino, and at Wilkinson in Pierce County. This stone has been used in the construction of many of the public buildings of the state. Similar use has been made of the granites at Index in Snohomish County and north of Spokane in eastern Washington. Road metal is obtained from the basalts of both eastern and western Washington. Quarries of this material have been operated from time to time along the Columbia River as well as in the Grays Harbor region and near Seattle.

In addition to the mineral products already described there are deposits of the rarer metals such as antimony, tungsten, molybdenum, and chromium whose extent and general character are at the present time very little known. The following table gives the value of the production of the different mineral deposits within the state during the years 1913 and 1914:

Non-metallic Products

	1913	1914
Coal	\$ 9,243,137	\$ 6,751,511
Clay Products.....	2,390,226	1,809,491
Portland Cement.....	2,350,898	1,140,121
Granite.....	773,194	1,068,042
Sandstone.....	560,468	450,436
Limestone.....	62,913	62,913
Marble.....	Not given	189,260
Lime.....	Not given	28,777
Mineral waters.....	18,886	
Sand and gravel.....	385,886	324,628
Totals.....	\$15,964,501	\$11,825,179

Metallic Products

Gold	\$ 696,275	\$ 557,173
Silver	200,068	146,468
Copper	147,883	103,571
Lead	8,909	2,555
Totals	\$ 1,653,135	\$ 809,767
Grand Totals	\$17,617,636	\$12,634,946

THE GROWTH OF THE CITIES OF WASHINGTON

By W. M. Gregory*

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“WHY, I would not give a pinch of snuff for the whole country! Do you think your honest farmers of Pennsylvania, New York, Ohio, Illinois or Missouri will leave their farms and go on such an enterprise as this?” This is the statement of United States Senator McDuffie in 1843 when the Oregon Bill was passed in the Senate by a narrow margin. After its passage Daniel Webster, then Secretary of State, deemed the Puget Sound region of such slight value that it was nearly lost in the Oregon Treaty Negotiations of 1846.

The falsity of these short sighted visions has been fully shown by the subsequent amazing economic developments of the Northwest, making its present per capita wealth twice that of Ohio, Michigan, or Wisconsin. It is true that the first settlement in 1825 at Fort Vancouver on the Columbia River was a remote trading post of the Hudson Bay Fur Trading Company. It was fur that Captain Gray sought when he established a lonely station on Grays Harbor. The beaver skin was then valuable for hats but a change in London's fashions brought in the silk hat and with the natural decrease in demand for the beaver skin, the interest of the Hudson Bay Fur Company in this region gradually waned. It was a natural step from the fur to the fish of Puget Sound, and Doctor Manyard in 1852, one of the earliest settlers of Seattle, sought land along with the Denny family for a salmon packing plant. Along with these workers came one Yesler who built a saw mill near the fish packing shanty, thus the community started early in the progressive development of its natural resources.

The north to south extent of the Cascade Mountains through the center of the state was the barrier that determined the settlement of its eastern portion first. This was accomplished by Marcus Whitman in 1836 who established an Indian Mission at Walla Walla where he tilled the soil and first taught the natives how to irrigate the crops. On the western slope of the mountains the first settlements were along the edge of Puget Sound as it offered fine opportunities for trading and fishing. The first settlers on the Sound gathered at Tumwater, near the present site of Olympia, in 1844, and they at once harnessed the small stream for a combined grist mill and sawmill.

The real peopling of Washington was started by the Oregon Migration in the spring of 1843. This party, of more than one thousand people from Ohio, Indiana, Michigan, and other honest farmers of the middle west, had Marcus Whitman as one of the leaders and followed the Oregon Trail through the South Pass into the new country. Horace Greeley considered

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these people wholly insane but he lived to visit this region of marvelous possibilities and advised young men to go west.

The long caravans crawling slowly over the plains and the mountains did not bring the people very rapidly for in 1853 the total population was slightly less than four thousand and the native Indians numbered nearly six times the scattered groups of whites. The early comers spread over the new lands, selecting those sites that were best adapted for fishing, sawmills and trading posts.

RAPID DEVELOPMENT

Following this period of small struggling centers of industry came a rapid and a tremendous development when the great timber resources were suddenly made accessible by the railroads that were extended into this region with marvelous rapidity. One of the earliest railroads was at Walla Walla in 1876, its rails were wooden stringers covered with rawhide. Its traffic was frequently delayed by the starving coyotes eating the hide track which is a minor incident in the rapid railroad development that enabled the state to jump from the difficult trail and the slow caravan to the more expeditious steam road. In 1880 Washington had less than three hundred miles of railroad and in the decade that followed its mileage increased ten times and the same period had an increase of 375 per cent in population. These decades of wonderful growth in population were due to the sudden opening of the vast forests to lumbering. The railroad found a ready market in the east or at a shipping port on the coast for the lumber, the salmon, and the wheat. The western terminus of each road became a port for the outlet of the regions of production. Thus the gathering points for manufacture or for shipping were the places that had the greatest growth in the early development of the state's natural resources. At present more than one half of the people are living in manufacturing or shipping communities of three thousand or more inhabitants. Washington has leaped from an undeveloped region of scattered sawmills and fishing ports to an urban state in which its percentage of urban people ranks eleventh among the states. The wagon road stage of development that stands in the growth of a community between the trail and the steam road was rapidly hurdled. Hence the rural life has developed slowly and at present only one quarter of the state is in farm land, for the exploitation of the forests has offered a more rapid source of wealth than the slower process of soil cultivation.

IMPORTANCE OF PUGET SOUND

In the vigorous growth of the cities of the western part of the state the forests and the railroads have been controlling influences to which must be added the geographical advantage of their location on the salt water estuary of Puget Sound. This Inland Sea of the Northwest reaches nearly one hundred miles eastward with its narrow arms of deep navigable water that extend into the lands for more than a hundred miles to the north and south. This "Har-

bour Country" offers to commerce more than 1,900 miles of shore line, many deep and easily accessible harbors surrounded by a land of equable climate. Further, this body of water is nearer Chicago, Alaska and Japan than is the rival harbor of San Francisco, and this is a great geographic advantage for Puget Sound in the competition for Pacific commerce.

It is about Puget Sound that the most vigorous growth of cities has taken place. The counties contiguous to Puget Sound are about one fifth of the area of the state and yet they have more than one half of its total population. The railroads reaching westward to this Inland Sea have made cities where they touch the open and navigable water of the Sound. The growth and development of these railroad and port towns has been due at first to the lumber, then to the fish, and later to the rich resources of Alaska and the extensive markets of the Far East. The materials and outfits for the Alaskan development have been shipped largely from the Puget Sound ports and in return they have controlled the Alaskan products. In the Far East markets the Puget Sound ports show their advantage in distance by their greater imports of raw silk and far greater shipments of iron products than San Francisco.

SEATTLE

Seattle is the first city of the Northwest because it has the most advantageous site on Puget Sound for the union of sea commerce and land trade. Seattle owes its growth more to its commercial interests than to the development of its nearby resources of coal, water power, and timber. John Holgate was the sole inhabitant in 1850; the Denny party came in 1851 and when a few months later Yesler started a saw mill, Seattle gave promise of being a typical "sawdust and salmon" town. Twenty years later it had about one thousand people who had increased the number of saw mills and fishing shacks that were scattered among the piles of logs and lumber.

The builders of the railroads to the westward discovered (about 1884) that Seattle's site, midway on the eastern edge of Puget Sound on a nearly straight channel to the ocean, was the strategic point for railroads to meet the deep sea navigation. Seattle is on a narrow peninsula between Lake Washington (fresh water) and the salt water of Puget Sound. The city has grown about Elliott Bay, along whose edge are the great navigation docks and the various railroad terminals. Entering Elliott Bay from the south is the Duwamish River, the tidal flats of which have been improved by dredging and filling, so that the two distributaries of the river are now known as the East and West Waterways and form commercial assets of great future value. North on this deep bay is Smith Cove where the largest steamship docks have been constructed. Extending through the northern portion of the city is still another addition to its commercial advantages—the long, narrow Salmon Bay, Lake Union and the Government ship canal that connects Union Bay, an arm of Lake Washington, with Lake Union and thus with the Sound. The area of the city that has been developed under these favorable conditions is some

fifty-eight square miles of land, while its lake and rivers are some eleven square miles and the salt-water about twenty-four square miles in addition. The land rises suddenly from the water's edge and in places like Magnolia Bluff the steep banks are very near the shore. The surface is one of rolling drumloidal hills with the longer axes generally north and south. The hills rise three to four hundred feet above the water and their summits are fine residential sites but they were such a disadvantage in the business section that they were removed in a true western fashion. The loose gravels and clays made it an easy task to use hydraulic streams to remove enormous quantities of the earth and in places a depth of more than eighty-five feet was removed to make the sixty miles of level streets required in the business section.

Seattle's growth was slow at first. Its trade was chiefly lumber and fish, but the coming of the railroad in 1884 was the initiation of a period of astonishing growth. In the twenty years from 1880 the city grew from three thousand to over eighty thousand. This was a time of the opening of one new field after another. First it was lumber and fish, then Alaska and the Far East trade. In 1896, with the discovery of gold in Alaska and the feverish rushes to the Klondike in 1897, followed by the opening of the Nome and Fairbanks region, Seattle's position gave it almost a monopoly in their trade. It was the logical outfitting center and likewise the port of entry for the gold, furs, and fish of the new lands.

The Far East trade for Seattle began about 1896 with the establishment of a steamship line to the Orient. Seattle holds first rank on the Pacific Coast in foreign imports of raw silk, tea, and fiber, while it exports canned fish, iron-ware, lumber, and coal. The foreign trade has grown from 15 million to 56 million dollars (1914). The domestic trade for 1914 was nearly 50 million dollars, one third of which was Alaskan. The building of railroads in Alaska will further stimulate this trade and the Panama Canal is furnishing a more direct and cheaper shipping route for products from Seattle.

Seattle's chief asset is its harbor; it is a typical port city and young as it is, ranks sixth among the ports of this country. Its advantageous position, at the "break in transportation" on the shortest trade line between our eastern states and the countries of the Orient and Alaska, has been the controlling factor in its development. The following table is an attempt to give definite value to the various influences that have been contributing factors in Seattle's growth:

	<i>Per Cent</i>
1. Commercial resources of its tributary lands	20
(Alaska, Far East and the Puget Sound region)	
2. Water transportation and ample dockage.....	15
(Deep water harbor and municipal docks)	
3. Geographical location and advantages of shorter routes.....	15
(Strategic trade point on Puget Sound and on the shortest line between the Orient and the Eastern States)	

4. Railroad connections and seven competing lines	13
5. Climatic conditions of fogs, winds and temperatures.....	10
6. Character of citizens—"The Seattle Spirit".....	8
7. Topography and future area for expansion of trade and shipping....	7
8. Age of city and surrounding country	6
9. Previous rate of growth	6
Total	100

Seattle is a young city that has about passed its period of most vigorous growth and its future increase will be slower. It is more than possible that the present time is one of those halts that frequently occur in cities that have had a very recent vigorous growth. In 1910 Seattle was the twenty-first city in population and in an estimate issued in July, 1915, it was ranked as the nineteenth city. This was based entirely upon the rate of increase previous to 1910 which the writer believes is much too high for the present times.

SPOKANE

Spokane, the second city of the state, began with a saw-mill and three men in 1872. The Indians regarded the falls of the Spokane River as the manifestations of the Evil Spirit, but the white men readily perceived their value for water power which is the present basis of the city's industrial strength. The growth was gradual until 1885, which was the year of the discovery of the rich Coeur d'Alene mines a few miles to the eastward. Since the opening of these mines, the city's growth has been vigorous, even the disastrous fire of 1890 was only a momentary check, and the city in 1915 had an estimated population of 142,990. Its rate of growth for the last decade is only slightly lower than that of Seattle. Spokane is a lumber center that draws its timber from the forests to the north and the east. It has many secondary industries that depend upon this lumber supply and cheap power. South and west of Spokane, the fertile and level lava plateau lands are the grain fields that supply the wheat for flour milling that ranks second in the industries of this "Minneapolis of the West." The industrial interests of which Spokane is a center are so different from those of the Puget Sound region that the state naturally divides into two political parties in direct response to these two physiographic regions that are respectively east and west of the Cascades. Spokane is the center of the Inland Empire and it is of interest to note in this connection that as late as 1907 it was seriously proposed to make this region a state, giving it the name of Lincoln.

TACOMA

Tacoma owes much to a group of railroad promoters who gave the city financial and transportation advantages as a stimulus to a growth that might have been greater had their sense of geographical location been keener. In 1873 this town of three hundred people was selected as the western terminus

of the Northern Pacific Railroad. The railroad promoters purchased some three thousand acres of land and controlled nearly thirteen thousand acres of the surrounding land. The city was planned at the head of Commencement Bay; vast sums were spent in building depot, warehouses, docks, and repair shops. The city has had its most rapid growth since it has been reached by competing railroad and steamship lines. The city is on a peninsula standing between Commencement Bay and the Narrows of Puget Sound. Where the Puyallup River enters Commencement Bay in the northeastern part of the city, the present extensive shipping interests had their origin. The present harbor has fourteen miles of water front and the city handles about forty per cent of the import and export trade of Puget Sound. The chief industrial interests are lumbering, flour milling and meat packing. The city had an estimated population in 1915 of 108,094.

INDUSTRIAL RESOURCES OF WASHINGTON

By H. K. Benson

Director of the Bureau of Industrial Research

University of Washington

ALTHOUGH the state of Washington has not developed a great manufacturing industry it nevertheless possesses an abundance of raw materials and certain other advantages which are unique and which give promise of extensive development in the future. Combined with a wealth of natural resources, the state contains a variety of exceedingly valuable secondary conditions, such as the equable climate of the coast, great harbors constituting a gateway for commerce with Alaska and the Orient, a topography yielding enormous water power, together with great scenic beauty. It is of interest to consider these various factors as fields for possible development.

PRESENT INDUSTRIAL DEVELOPMENT

According to the figures of the last census the various industries of the state produce commodities valued at over 330 million dollars annually. Of this amount about one-third consists of agricultural products distributed as follows:

Grain	\$ 78,927,053
Domestic Animals	10,249,346
Dairy Products	8,746,041
Eggs	4,311,000
Orchard Fruits	4,274,000
Garden Truck	3,000,000
Small Fruits	941,000
Total Agricultural Products	\$110,448,855

The total annual value of all manufactured products is reported at \$220,746,000, representing a capital of \$222,261,000 and employing 80,118 persons. Approximately 40 per cent of the manufactured products consist of lumber and other forest products, and this constitutes the largest industry of the state. Other manufactured products include flour mill and grist mill products, slaughter house products, canned or preserved fruits, meats, fish, etc.; foundry and machine shop products, butter, cheese, condensed milk, etc.; candy, crackers, pickles, baking powder, and other food products; brooms, cordage, trunks, woolen goods, jewelry, and other household commodities.

INDUSTRIAL RESOURCES

A survey of the state's resources shows that in many cases only a fractional utilization is made of the available raw materials and that manufacturing operations are capable of considerable expansion. A brief discussion of some of these possibilities will be given.

FOREST PRODUCTS

With nearly 400 billion board feet of standing timber and an annual cut of about 4 billion feet it would seem that the lumber industry will safely last for a century. In fact with a sane and constructive policy of reforestation of non-agricultural land there is reason to believe that the lumber industry will be permanent.

In the manufacturing of lumber, in logging and in land clearing operations a great waste of wood is now occurring. The quantity of wood cut is two or more times as great as the lumber actually produced. While some of this is used for fuel, much of it may be regarded as waste and is actually burned in order to get rid of it. In the manufacture of lumber each year the waste wood is said to approximate roughly 500,000 cords of logging waste left in the woods, 900,000 cords of sawmill slabs, and 1,000,000 tons of sawdust. Graphically it represents when cut into sizes of cordwood dimensions and then piled, a wall of wood 3000 miles in length, 4 feet in width, and 4 feet in height.

From the experiences of this and other countries where closer utilization is practiced, it is apparent that an opportunity exists for the establishment of secondary industries which will use this waste wood as raw material. The resinous woods yield by distillation, turpentine, tar, rosin and charcoal; the bark of the hemlock is rich in tannin; sawdust can be converted into alcohol; and wood pulp can be made from many species. Power in great quantities can be cheaply obtained from this waste by means of gas producers or steam turbines.

FERTILIZERS

The fertilizer resources of the state are almost of equal importance with its forest products. From the waters of Puget Sound about one-fourth of the fisheries products of the Pacific Coast are obtained. From the canneries may be obtained large quantities of fish offal which may serve as a raw material for nitrogeous fertilizer and for fish oil. It is estimated that at least

\$50,000 worth of waste might annually be sold to fertilizer plants which in turn will produce fertilizer materials and oil worth more than \$200,000. Floating upon these same waters are the great beds of the giant kelp or sea weeds. These have been mapped by the United States Bureau of Soils, and, according to the survey, the kelp beds of Puget Sound produce annually 500,000 tons from which may be extracted 16,000 tons of potassium chloride. In connection with the kelp beds of the north Pacific on this western coast of America, more than twice as much potash may be extracted as is annually imported in normal times from Germany.

Recent investigations show that phosphate rock may be converted into soluble forms through the agency of the electric current. The large deposits of phosphate rocks in Idaho and the cheap water power of Washington with its abundance of coal and limestone offer favorable facilities for the manufacture of phosphate fertilizer material. In the manufacture of nitrates with our cheap water power and of other nitrogeaneous fertilizers from fish waste; of potash from kelp; and of phosphates, the state of Washington will eventually develop a large industry.

POWER

In the past, the industrial welfare of a community was dependent upon its nearness to a coal deposit, but in the Northwest coal has competitors in the great quantities of oil from California and the electrical power of its mountain streams. The total available coal supply of Washington is computed at 20,000,000,000 tons and nearly 4,000,000 tons are mined annually.

From the mountain streams of Oregon and Washington and within economical transmission to our larger cities on tide water may be generated at least one-fifth of the available water power of the United States, exclusive of Alaska. It is currently stated that electrical power can be generated at a cost not exceeding \$7.50 per horsepower year, thus enabling electrical power to be used in the establishment of electro-chemical industries such as the production of oxygen, chlorine, bleaching powder, peroxide, nitrates, etc.

AGRICULTURE

Agriculture is yet a dormant, undeveloped industry. Less than 10 per cent of the agricultural land of Washington has been improved and utilized for agriculture. More than 2,500,000 acres of logged-off land of agricultural character remain uncleared and idle. This is due chiefly to the high cost of clearing the land of stumps and debris left by the logger. In central and eastern Washington the problem has been different. Instead of the jungle the desert must be overcome. Irrigation has transformed large areas into orchards and meadows of great beauty and productiveness. But even there out of 2,000,000 acres of irrigable land not more than 25% has thus far been reclaimed.

The urgency of a more highly developed manufacturing industry may be illustrated by citing a single instance of the dependence of Seattle upon out-

side sources to supply the needs of its people. In this city of 300,000 population, during the past year, 7,207 cars of vegetables and fruits were shipped into the city. This is equivalent to a carload for every seven families. Of three million packages making up the total receipt, a million and a quarter came from outside the state. Four transcontinental railway lines and sixty-four water lines enter Seattle and bring their cargoes for distribution.

In conclusion, if one looks forward with prophetic vision to the industrial development he will see a great dairy industry centered in the humid regions of Puget Sound and the Coast; a great diversified farming industry; fruit and grain growing in the central and eastern portions of the state; and factories with their multitudes of workers utilizing nature's stores and harnessing the latent power of her wonderful mountain streams.

The Mineral Resources are treated in a special article, p. 343.

THE SPOKANE COUNTRY; ITS INDUSTRIES AND CITIES

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THE Spokane Country in Washington is that portion of the state east of the Cascade Mountains. It includes topographically the Columbia Lava Plateau, the Okanogan Highland in the north and the Blue Mountains in the south-east. Here we have the noted wheat sections, the Big Bend and the Palouse, the general farming area in the southern part known as the Walla Walla country, and the fruit sections, the Yakima and Wenatchee Valleys in the western part.

The Spokane Country was pronounced by early travelers as a "region unfit to be the home of civilized man." Now nearly one-half million people inhabit the portion of the Spokane Country which is in Washington alone. In this region we find some of the richest and most productive agricultural land in the United States.

HISTORY

The early travelers already mentioned, based their opinion on the apparent worthlessness of the area and the seemingly light rainfall. In 1853, General Stevens stated that there were several "stretches of eastern Washington which invited settlement." The discovery of gold in the region in 1855 attracted attention. The military settlement of 1856 near the Whitman settlement of 1836 in Walla Walla County included a few settlers. Walla Walla County had 1300 white people in 1860.

In 1858, Spokane County was created by the territorial legislature. It included all land west of the Rocky Mountains, east of the Columbia River and north of the Snake River. The admission of Oregon as a state in

1860 left all of south Idaho, and parts of western Montana and Wyoming in Spokane County.

The Spokane County so defined was abolished in 1864 and the territory was annexed to Stevens County. This held until 1879 when it was again formed and the county seat was temporarily located at Spokane Falls which in 1887 was made the permanent county seat.

POWER

Eastern Washington has a great deal of water power of which the larger portion is undeveloped. One of the best developed areas is that of the Spokane River which drains an area of roughly 6,000 square miles, but nearly three-fourths of it is in Idaho. The area reaches to the Bitter Root Mountains and includes all of the tributaries of Lake Coeur d'Alene for it is this lake that has for its outlet, the Spokane River. In a distance of 100 miles Spokane River has a fall of 1280 feet, 130 feet of this being in the city of Spokane; the power has been developed by the Washington Water Power Company. They have fully developed 87,000 horsepower, have developed but not fully equipped 33,000 horsepower and have 25,000 horsepower entirely undeveloped making in all 145,000 horsepower from this river. This power is used in the city of Spokane for electric railways, lighting, and furnishing power to a large number of factories. The company also furnishes power to cities and towns in a radius of 75 to 100 miles in the Inland Empire. The power stations of the company are located at Little Falls and Long Lake, not very far from the mouth of the river, at Spokane, and at Post Falls near Coeur d'Alene city.

Other important projects which have great possibilities in water power production are (1) that of the Pend Oreille River where a maximum estimate of 350,000 horsepower is made, (2) in Chelan County, an equal estimate of horsepower from the Chelan River, Entiat River, and Columbia River, (3) in Franklin County from the Snake and Columbia rivers. The Priest rapids in the Columbia River have possibilities of nearly half a million horsepower.

INDUSTRIES

Cereal Production.—In a report made by R. D. Jarboe, chief grain inspector of this state, practically everyone of the twenty counties of Eastern Washington is mentioned as having a wheat yield for the past year. In this report of Washington's 50,000,000-bushel wheat crop, he states that "not only has it proved the largest, but of good quality—contrasted with the badly damaged conditions of the grain crop in almost every section of the United States."

A remarkable feature of wheat production in this state is its small fluctuation from year to year in total yield.

The Total Wheat Production

1909	40,000,000 bu.	1913	53,000,000 bu.
1910	35,000,000 bu.	1914	41,000,000 bu.
1911	50,000,000 bu.	1915	50,000,000 bu.
1912	53,000,000 bu.		

The data for 1915 are from the report made by Mr. Jarboe, the others from the year book of the Department of Agriculture.

The ten year average yield per acre for winter wheat is 26.1 bushels, and for summer wheat is 19.6. These yields lead any of the other important wheat producing states.

GRAIN GROWING REGIONS

The first important grain producing area is the Palouse country centering in Whitman County. This county alone in 1915 produced over 11,000,000 bushels of wheat and 4,000,000 bushels of oats and barley. The yield of winter wheat in this section is from 30 to 60 bushels per acre. The rainfall ranges in this county from 21.03 inches on the east side to 17.22 inches in the west. The soil is colian and is a very fine basaltic loam. Spokane County north of Whitman County with similar conditions of soil and rainfall produces 2,000,000 bushels of wheat.

A much larger area is that known as the Big Bend which includes that portion south and east of the Columbia River in the bend of that river. This area contains the counties of Lincoln, Adams, Grant, and Douglas and altogether produced 20,000,000 bushels of wheat this year. Franklin County bordering the section on the south added another million bushels to the total production of the state. Comparatively a large area is included in the Big Bend region, nearly one-sixth of the area of the state, yet the yield per acre is not large on account of the light rainfall. The rainfall in the northern and eastern part of the belt is slightly above 15 inches but in the southern portion, it is less than 10 inches.

Another area south of the Snake River including the counties of Walla Walla, Columbia, Garfield, and Asotin, although only two-fifths the area of the Big Bend, last year produced 10,000,000 bushels of grain. The soil in certain parts resembles that of the Palouse and the rainfall is about the same.

Fruit Production.—There are several irrigated areas that have national reputation for the fruit produced. One of these areas is in Chelan County where practically 35,000 acres are planted to apples; another section, Yakima County, shipped in 1914 over three million boxes of apples, one-half million boxes of pears, and one million boxes of peaches. Other fruit areas are found in Spokane, Okanogan, and Walla Walla counties. Benton County is noted for its small fruit.

CITIES

Spokane, population, 1910, 104,402; U. S. Census bureau estimate in 1915, 142,190, has had a phenomenal growth. The first settlement was made in 1870. The population in a little more than ten years had grown to 1500 and in twenty years was 20,000. The city in 1889 was visited by a fire that destroyed thirty-two blocks in the heart of the city.

A recent writer gives the cause for Spokane's development as the falls and the wheat production in the Palouse and Big Bend. To these two causes must undoubtedly be added a third, namely its position in reference to natural routes for railroads to the coast. Spokane is truly the entrance to the state from the east. Two natural ways for approach are possible and are used. One is on the north by the way of Clarks fork of the Columbia, Lake Pend Oreille and then across to the Spokane River. This route is used by the Northern Pacific railroad. Another route is by the way of the Kootenai River, thence to Lake Pend Oreille and to the little Spokane River; used by the Great Northern. Other roads, namely the O. W. R. R. and N. Co., and Chicago, Milwaukee and St. Paul enter by way of tributaries of the Spokane River to Lake Coeur d'Alene. With one exception the transcontinental lines leave Spokane going westward by way of Hangman (Latah) creek and Marshal canyon by way of Cheney. In a distance of sixteen miles an ascent of 400 feet is made and the railroads reach the plateau where the elevation is near 2400 feet.

The transportation facilities of Spokane are excellent. In addition to the five transcontinental lines, there are important branch lines radiating to all parts of the Inland Empire. There are also two electric lines having an interurban system of 213 miles.

The following quotation from a letter received from the Industrial Department of the Chamber of Commerce of Spokane indicates the importance of Spokane industrially: "A careful estimate placed on the amount of the freight bills is \$1,385,000 monthly; this makes a total of \$16,620,000 per year. Freight charges probably represent on an average 30 to 35 per cent of the value of the goods, so that on a 30 per cent basis, the value of these shipments would be \$55,400,000. We have three flour mills here, the Centennial Flour Mill, the Spokane Flour Mill and the Portland Flour Mill. The combined output would be approximately 550,000 barrels per year while the Centennial Mill makes in addition a line of cereals, the output of which would probably run 120,000 barrels per year. Of the many saw mills in this country we have only two in Spokane. We do not have any figures on those outside, but the Phoenix Lumber Co. of this city has an output of approximately \$450,000 per year while the McGoldrick Lumber Company's output is about \$500,000 per year. We have in all lines about 250 manufacturing firms in this city. The capital invested, including the public service corporations, is \$50,926,000. The number of operatives is about 10,000, the annual wage, \$8,104,174 and the annual products of these factories about \$50,000,000. One of our factories of which we are particularly proud is the Inland

Empire Paper Mill. This concern was established here about four years ago and its total output for the first year was \$150,000. During the past year, its payroll was \$150,000 and the output was over \$1,200,000. They are shipping their products over a wide territory; in fact, all of the states of the northwest, as far east as Montana and Utah and as far south as Los Angeles, California. In addition they are doing some exporting to the Hawaiian Islands."

Walla Walla, 19,364 in 1910; U. S. estimate, 1915, 24,205, is located in an area noted for its general farming produce. It lies south of the Snake River and includes some of the best farms of the state. The commercial club furnishes the following data of produce shipped from Walla Walla during 1915:

Onions	200,000	sacks
Asparagus	250	tons
Rhubarb	500	tons
Beans	100	tons
Cabbage	500	tons
Green Peas	50	tons
Tomatoes	100	tons

Potatoes, carrots, spinach, and other garden stuff to the value of approximately \$100,000. This does not include the grain received in the city warehouses. Manufacturing amounts annually to \$3,000,000. Whitman College, one of the older educational institutions of the state is located here.

North Yakima, (14,082; 1915, 19,844). Located on the Yakima River, it is the center of an important irrigated section of the state. It has good railway facilities being served by the Northern Pacific and the Oregon-Washington lines. It has several important manufacturing plants among them being flour mills, creameries and lumber products mills. The Washington State Agricultural fair is held here annually.

Ellensburg, 4,209, a city northwest of North Yakima on the Yakima River, is also surrounded by a large acreage of irrigated land. It is located on the main lines of the Northern Pacific and the Chicago, Milwaukee and St. Paul railroads. Several creameries, two flour mills and a number of other enterprises make it an important city. One of the state normal schools is located at Ellensburg.

Wenatchee, 4,050, is located on the west side of the Columbia River at the mouth of the Wenatchee which furnishes an abundant supply of water for irrigation. The city and surrounding country is all one vast orchard broken up into ten and twenty acre tracts. It is the largest city on the Great Northern Line between Spokane and the coast. It is also the junction of branch lines north and northeast and is the lower point of boat service on this portion of the Columbia.

Colfax, 2783, is the county seat of Whitman County in the heart of the Palouse. On account of the topography surrounding Colfax it is not an im-

portant shipping point for wheat in the county. It is the terminal of the Spokane and Inland Empire electric line and is also on the main line of the Oregon-Washington Railroad and Navigation Co.

Pullman, 2,602, located also in the Palouse is noted most of all as the home of the Washington State College and is one of the pleasant home cities of the state. It is surrounded by a rich agricultural region.

Dayton, 2,389, is in the southern part of the state in a county noted for its cereal production. Columbia and Garfield counties produce more barley than any other section of the state. Nearly a million bushels of grain are marketed at Dayton annually.

Pasco, 2,083, near the mouth of the Snake River on the Columbia, is an important transportation center. It is a railroad center and has also excellent steamboat service since the completion of the Celilo Canal. Through this it has cheap transportation rates for an inland city.

Ritzville, 1,859, is the leading grain market in Adams County, a county that ranks third in wheat production in the state. A large flouring mill of 450 barrels daily capacity, furnishes its products to Europe and the Orient and justifies Ritzville's slogan, "The Bread Basket of the World."

Tekoa, 1,694, in the Palouse country is a thriving wheat market and railway center.

Pomeroy, 1,605, is the county seat of Garfield County and one of the principal shipping points for wheat and barley in the state.

Palouse, 1,549, on the Palouse River, is a trading center for a large section. It is provided with two flour mills and a creamery.

Colville, 1,512, county seat of Stevens County, a rich agricultural section, is located in a wide portion of the Colville River valley. The county has several good mines in operation, has large deposits of marble and a large amount of standing timber.

Prosser, 1,298, and *Kennewick*, 1,219, the leading centers in Benton County, are surrounded by a large acreage of irrigated land. The strawberry crop in 1915 netted the county \$10,000,000.

Davenport, 1,229, county seat of Lincoln County in the Big Bend is the center of wheat shipping in this county that ranks second in importance in the state.

FIELD COURSE IN GLACIER AND YELLOWSTONE PARKS

Professor E. J. Saunders of the Department of Geology of the University of Washington will conduct a geological field course in the above named National Parks from June 19 to July 28. The party will be limited to 30. Cost \$150 to \$180. For particulars address Professor Saunders. An excellent opportunity to combine pleasure, recreation and the most effective kind of geological instruction.

SOME GEOGRAPHIC INFLUENCES OF EASTERN WASHINGTON IN RELATION TO AGRICULTURE

By H. J. Lechner

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THE generally accepted idea that Washington comprises two distinct geographic sections is only relatively true. The geographic differences in Eastern Washington, especially as they affect agriculture, are about as marked in some cases as between the two main parts of the state. Rainfall and soil are the important influences, but altitude and topography too help to determine the products of different sections. In Kittitas Valley, sometimes known as the Upper Yakima, we are told that the higher altitude in comparison to Yakima will ever keep fruit-growing from being of first importance as an industry. However, the wide variation in the soil and subsoil and the less intensive irrigation have an important influence in preventing extensive reduction in size of farms and hence keeping out the possibility of extensive small orchard tract planting. The Kittitas Valley timothy hay is of first quality because of uniformly good weather for curing, and not because of soil adaptation. Yakima Valley proper produces larger quantities of hay (alfalfa), but the difference in soil, the lower altitude, the more intensive irrigation all have an influence in making this primarily a fruit section.

Experience has shown, however, that in some localities here topography has had its influence in an agricultural adjustment by eliminating fruit growing in the lower levels subject to alkali, and to confine peach growing to areas with a better air drainage and not so subject to low spring temperatures. Lower Yakima Valley, the major portion of which is Benton County, differs agriculturally from the other parts of this Valley because of the lower altitude, and because of the coarse sandy soil,—these two also causing a higher average annual temperature. These are the influences which put Kennewick in position to claim the earliest strawberries in the state. The coarse sandy soil warms up quickly, hence the early start of this crop. In this county too we can, because of the relatively high air and soil temperatures, easily believe the great possibilities in growing corn which have already been fully demonstrated. The type of soil and the winds also have resulted in some adjustment among farmers who have learned by experience the losses resulting from blowing soils where large areas of uncultivated ground are left exposed. Alternating narrow fields of alfalfa and cultivated crops are an illustration of how this has been overcome in a great measure. The entire Yakima, the Wenatchee, and Spokane valleys produce the major part of Washington's ten to eleven million dollar apple crop. Walla Walla County, and small sections on the Snake and Columbia rivers produce most of the remainder. The many sunshiny days of the growing season throughout these sections are the important factor, causing the rich coloring that is so predominant in the state's apple crop. The low cost of producing roughage, the hay prices, and

high prices of dairy products have all caused an increase in dairying through the irrigated districts.

The wheat producing area, largely because of differences in rainfall, comprises two rather distinct types of grain farming. In the Big Bend country parts of Benton, Klickitat, and Walla Walla counties and the higher lands of the irrigated districts that can not be watered, and where the rainfall usually does not exceed 16 inches, crops can be grown only on alternate years. In the other years the land is left fallow, first to save moisture for the following crop; second, to kill weeds; third, to store up plant food. Careful observation of the dry land farming experts show that even with the best methods of tillage only 70 per cent of the 12 to 15 inches of rainfall in typical areas of the Big Bend can be made to enter the soil. By clean and careful summer fallowing 80 per cent of this will still be in the soil the next fall. On this basis about 7 inches of rainfall is in the soil at fall seeding time, or 14 inches for the two years. As no crop can use all moisture present we do not have more than 12 or 13 inches in this region to be used by the wheat. Observations have also shown that each of these 12 to 13 inches will produce about 2.5 bushels of grain, making a possible yield of 30 bushels per acre under proper methods. This is even excelled by some of the best farms in the Big Bend country. It is here that our wheat farmers best heed agricultural teaching, for they realize that the difference between careful and careless work means the difference between success and failure. Here, as throughout the entire wheat section, the possibilities of high yield lie fundamentally not merely in the quality of the soil, but in its high moisture holding capacity, and the fact that the rainfall comes in the late fall, the winter, and early spring season.

The middle western farmer has had to learn dry farming a second time when he came to grow wheat in Washington, because here, with winter season precipitation, the soil must be fall-plowed and made receptive to this moisture, while in the middle west a large part of the moisture supply comes in the growing season. In the Palouse country and southwestern Washington fall plowing is doubly necessary, because of the heavier rains and the very rolling character of the land. It is not difficult to see, then, that Washington dry-land farming methods are an effort, by the best known means, to adjust agriculture to geographic influences peculiar to the state. In some cases these efforts fail, due to a soil that does not hold moisture, especially when the season is unusually windy. That is mainly why even the best methods sometimes fail, with seemingly small differences in rainfall and wind. The soil, poor in power to hold and store moisture, as well as the low rainfall (below 10 inches) both are influences determining the limits of areas fit for wheat production.

In the Palouse Country, constituting mainly the southern part of Spokane and all of Whitman counties, and southwestern Washington, the area south of the Snake River and east of the low rainfall belt at Pasco, the additional rainfall and difference in soil are responsible for methods of farm-

ing used here. Scientific agriculture has shown that some crops can be raised in this section every year, and hence the introduction of corn, field peas, and other crops, and therefore also an increase in livestock production. Both in moisture holding capacity and in natural fertility this soil is unexcelled. Maintaining a high state of wheat production means careful saving of moisture (but not from one year to another, as in the Big Bend), keeping down weeds, and raising of crops as adjuncts to wheat farming which will keep up fertility. Little land needs to be left idle, primarily because of the additional 6 to 8 inches rainfall. Therefore, farming is more profitable and land values higher.

Weather conditions and topography are also important influences determining harvesting methods. Whereas in southwestern Washington the binder is hardly seen, it predominates in the northern Palouse region. Here the binder seems necessary because of the presence of dews in harvest time and of the less uniform ripening. Never, as is the case farther south in the state, do we find "from header to thresher" harvesting. Headed grain is stacked here. The greater use of the combined harvester in the more level areas is due to the necessity of keeping the speed of the machine as uniform as possible. However, this difficulty has been partly overcome by running the machinery by different power than that which draws it over the fields. While important local influences of climate and soil determine adaptation of varieties and types of wheat, nowhere in the United States are the non-shattering club wheats so popular. This characteristic is so essential here because the climate makes it possible for farmers to allow wheat to stand in the field long after it is dead ripe, and therefore to harvest greater areas with the same equipment.

The eastern Washington counties bordering Canada (sometimes known as the Okanogan Highlands) comprise comparatively little in the way of developed agriculture, except in the line of stock raising. Topography has its influence in making agriculture here rather varied. Even in the small irrigated valleys farming is more diversified. The development of natural resources, better communications, and the settling up of large areas of land still to be taken, will have their influence on agriculture in this region.

Thirteen counties in eastern Washington, in districts designated as the Big Bend, the Palouse and the Walla Walla, west and south of the city of Spokane, produced, in 1909, a crop of 35,095,000 bushels of wheat, 6,000,000 bushels of oats and 4,500,000 bushels of barley, besides several million dollars' worth of fruits, vegetables and grasses. Whitman and Lincoln counties led all in the area devoted to grain, producing 16,500,000 bushels of wheat, of which 8,500,000 is credited to Whitman county, which also has first place with 3,000,000 bushels of oats.

THE PORT OF PUGET SOUND

By Albert C. Herre

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SEATTLE

THE Port of Puget Sound, which includes all the cities around the Sound, surpasses all other Pacific Coast ports of the United States in the volume of its commerce, ranking next after New York, New Orleans, Boston, Philadelphia, and Galveston, in the order named. This is due not merely to the immense quantity of foreign and domestic goods which naturally passes through the cities of Seattle and Tacoma, en route to the Orient or the eastern states, but to their peculiar advantages over some of the cities now ranking higher in the above list. Nearly all the cities included in the Port possesses not only great natural and agricultural resources, as yet but partially developed, but these are allied with large and rapidly increasing manufacturing interests. This last is made possible not only by the extensive neighboring coal fields and cheap fuel oil from California, but more especially by the utilization of the adjacent mountain torrents and waterfalls for the development of electric power. This is here produced in such quantity and at so low a cost as to rival any region in the world for cheapness. As yet, this resource is only beginning to be developed. Combined with the wonderful harbor facilities and nearness to the Orient, and the admirable transcontinental railway connections, the conditions are almost ideal for the development of one of the world's greatest seaports.

Imports.—Silk worth \$44,000,000, mostly in the raw stage, passed through the Port of Puget Sound in 1915, most of this through Seattle, which city is easily the leader of the cities of the Port district, not only in volume of imports and exports, but in domestic trade, manufacture, and finance. Tea, nearly \$5,000,000 worth in 1915, hemp from the Philippines, jute from India, rubber from the Straits Settlements and the Malay Peninsula, peanuts, copra, and curios are among the leading imports.

The local exports of greatest value are lumber and lumber products, canned salmon, condensed milk, wheat and flour, and fruit, especially apples. Wheat, which comes not only from eastern Washington, but from Idaho and Montana, is shipped to Japan when wheat is cheap, but more and more the manufacture of flour increases in Seattle, while the proportion of wheat exported decreases. Seattle itself produces no canned salmon or condensed milk, but as the financial and trade center of the state does an enormous business in these commodities, which go to all parts of the world. In 1914, 144,000 tons of canned salmon were handled in Seattle, while the trade in fresh halibut, herring, codfish, and salmon amounted to 27,000 tons. There is also a vast tonnage of cotton, steel and iron products, machinery, and general merchandise trans-shipped through Seattle from the southern and eastern states to the Orient.

The domestic coastwise trade is very extensive, but is especially large with Alaska, which draws her supplies of all kinds from Seattle, sending in return her salmon, furs, and gold. With the permanent opening of the Panama Canal, the coastwise trade with Atlantic Coast domestic ports will grow by leaps and bounds.

One factor, soon to be available, of great importance to Seattle as a shipping center, is the presence of Lakes Union and Washington. A ship canal is now in construction and within a few months the largest ocean going vessels may anchor in Lake Washington, where the coat of barnacles on the ships' bottoms may be removed at small expense, fresh water being fatal to these animals. The canal to Lake Washington is being built by the United States Government and King County, Washington, at a cost of \$3,625,000. The canal has one large lock and one smaller one, the former being the largest ever built on this continent, except the locks in the Panama Canal. The shore line, suitable for docks along the lakes and the present harbor is sufficient to afford ample room for all time to come.

Manufacturing.—The most important single manufacturing industry of Seattle, employing more men than any other, is the building of ships and vessels of all kinds, from a row boat to a battleship or submarine. Associated with the ship yards are the largest rope walk and dry docks on the Pacific Coast, and many large foundries, machine shops, and other metal working establishments turning out a great variety of products. Saw mills and shingle mills, sash and door factories, box factories, and other manufactures of lumber products, add much to the wealth of the city though not so important relatively in Seattle as in some other cities of the region. Here are the largest clay products plants, manufacturing jewelry plants, and shoe factory west of St. Louis, and an immense factory for making the tin cans necessary for the salmon and milk industries.

While Seattle is second among the cities of Washington in the manufacture of flour, she has the largest flour mill in the state, and with the completion of the additions now under construction will lead the state, her mills then having a daily capacity of 9,800 barrels.

The estimated population of Seattle in 1915, according to the United States Census Bureau, was over 330,000.

TACOMA

Like the other cities of the Puget Sound region, Tacoma is the outlet of a district having vast agricultural, forest, mineral, and fishing resources, and in addition is unsurpassed in harbor facilities and in possibilities as a manufacturing center. More than 100,000 horse power of electric energy is now available from the great hydro-electric plants which harness the melting-snow waters of the Cascades; it is believed that this can easily be increased to 1,000,000 horse power, affording cheap power for an incredibly great development of Tacoma as an industrial city.

Tacoma is the chief outlet for the great wheat district of the Inland Empire, and is the largest wheat shipping and flour milling point west of Minneapolis. Her mills have a daily capacity of 9,500 barrels.

Manufactures.—The value of Tacoma's annual output of flour and cereal products is \$8,000,000. The leading manufacturing industry is that of lumber and other wood products to an annual value of \$10,000,000. Dressed meat and packing house products are valued at \$5,000,000 annually; the largest car shops in the northwest are maintained here by the Northern Pacific company, and car wheel shops, machine shops, foundries, and iron works are among the city's industries. The plant having the most valuable product and certainly the one appealing most to the imagination is the great smelter, the largest west of Butte, Montana. Here are treated silver, lead, and other ores from all the states of the west and northwest, copper ores from Alaska and Peru, tin ores from Bolivia, Malaysia, and Alaska, and gold and silver concentrates from nearly all regions bordering the Pacific. The European war is responsible for the diversion of some of these South American ores from Wales to Tacoma, but it is believed that with the development of tin mines in Alaska a great tin smelting and tin-plate industry will grow up here which will permanently hold the purifying of Bolivian tin. In 1911 the value of the smelter output was \$11,709,000; since that time the smelter has been enlarged and its product is worth proportionately more.

From the Orient Tacoma receives silk, tea, matting, curios, peanuts, camphor, porcelain, jute, hemp, spices, and a vast miscellaneous list of commodities, while in return she sends in addition to the Washington exports already named, much raw cotton, machinery, and general merchandise.

A large ocean traffic is also carried on with Alaska, California, South America, and European ports. The total export business for 1911 was valued at \$25,899,628, while the total import business amounted to \$21,566,089. At the present time the volume of business is much greater but exact figures are not available.

The estimated population of Tacoma, July 1, 1915, was 104,000.

The shipping facilities of Washington, with its 2000 miles of shoreline, its great inland sea, and about 1000 miles of navigable rivers, are unsurpassed anywhere. Different lines of freight and passenger vessels connect all the larger ports of the Pacific with the railroad terminals on Puget Sound, Grays Harbor, and Columbia River. In addition to Washington products shipped from these ports, cotton, steel rails and many other articles are brought from the east and south by rail and are shipped to the different Pacific ports in return for rice, silk, hemp, fruits, and all kinds of merchandise not grown or manufactured in our own country. Hundreds of small boats ply on the waters of Puget Sound, and the various rivers, handling freight and passengers from more than 200 ports on these waters.

CITIES OF NORTHERN PUGET SOUND

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BELLINGHAM

BELLINGHAM (24,300 in 1910, present estimate 33,800), enjoys an unrivalled scenic location at the head of Bellingham Bay, a northern arm of Puget Sound. Four early trading and coal-mining towns situated around the bay finally coalesced to form the present city. The principal streets, one above another on the sea-facing slope of Sehome Hill, follow the curving outline of the shore. The homes on the heights command a view of the business section of the city, of the Cascades and snow-capped Mount Baker to the north and east, of the San Juan Islands and the Olympic Mountains to the west and south.

Due to the prevailing westerly winds off the Pacific Ocean, there are no seasonal extremes of heat and cold, the mean annual range of temperature being from 39° to 61.6° . The average annual rainfall is only 30.5 inches, the heavy precipitation usually attributed to this section being intercepted by the Olympic Mountains and Vancouver Island.

The Nooksack River, turbulently sourced in the mountains, has in its lower reaches built a broad, flat valley where dairy herds live in clover the year round. The soil is a rich silt loam very encouraging to truck gardening and flower culture, both of which have become important. Poultry raising is also an important industry in this valley. This large farming district is connected with the city by miles of well paved roads.

The largest salmon canning industry of the world is centered at Bellingham, the output amounting to millions of cases yearly. There are six lumber mills using the Douglas fir from the mountains, thirteen shingle mills utilizing the cedar, nine wood-working industries, two foundries, a mattress factory, a modern cement plant, several fruit canneries, brick and tile works, and boiler works. In 1911 the total value of manufactures exceeded \$7,000,000.

In 1907 a United States experiment bulb farm was established just outside the city where Holland tulips have bloomed ten days earlier than in their native land. Hyacinths and Narcissus thrive exceptionally well in this climate.

Transportation facilities are such as to make Bellingham an important commercial center. The harbor is deep and large. There are three miles of wharfage where ships from all parts of the world take on cargoes of lumber, shingles, cement, and canned goods. Two boats daily connect with Seattle, and others with various points on the Sound. Four railroads and an electric interurban give sixty-one trains daily. The Pacific Highway, a coastwise automobile road connects Bellingham with all the coast cities. The largest of three state normal schools is located in Bellingham.

EVERETT

Everett, the "City of Smokestacks," had in 1910 a population of 24,814, an increase of 216 per cent during the decade. The present local estimate is 30,000. It is advantageously situated on Puget Sound thirty-five miles from Seattle and about one hundred and fifty miles from the Pacific Ocean. It has twenty-two miles of deep water frontage with about three miles of wharfage including three deep-water docks. Everett is a port of call for some vessels plying between San Francisco and Alaska. Five steamers run daily to Seattle and one to Bellingham, while vessels from many parts of the world receive cargoes here. Four railroads give coastwise transportation service, and it is the first coast terminal of the Great Northern Railroad.

Along the water front are located many manufacturing concerns, the chief products of which (lumber, machines, and paper) are marketed throughout the world. The only arsenic plant in the United States is located here. There are two flour mills, a powder factory, a tannery, a brickyard, fish canneries and shipyards. The total annual payroll of its ninety manufacturing plants exceeds \$4,000,000.

In climate Everett shares with other Puget Sound cities the ameliorated conditions obtaining on western coasts of all continents where westerly winds prevail. The annual rainfall is 37 inches, the larger per cent of which occurs between October and April though occasional rains relieve the "dry" season.

SMALLER CITIES

Anacortes, population, 1910 census, 4168. Beautifully located on Fidalgo Island, a few hours by steamboat north of Seattle. It is an important seaport and is reached by the Great Northern railway. Its principal industries are lumbering and fishing, but it is surrounded by country adapted to diversified farming. There are nine shingle mills, two glue and fertilizer factories, six salmon canneries, two codfish plants. The total monthly payroll is \$100,000.

Mount Vernon, population, 1910 census, 2381, is located eight miles from Puget Sound on the navigable Skagit River from whose yearly floods it is protected by dikes. This town is important for its dairy industries including two large condensaries.

Blaine, population, 1910 census, 2289, is interesting as the most northwesterly municipality in continental United States. It is situated at the boundary line of British Columbia on Drayton Harbor. Its industries consist of salmon canneries, crab cannery, saw mills, box factory, lacquer factory, shingle mills and machine shops. Oysters are cultivated in the harbor.

CITIES OF SOUTHWESTERN WASHINGTON

Aberdeen (13,660) and *Hoquiam* (8,171) are located on Grays Harbor in the center of one of the best timber districts of the state. The industries of

both cities at present depend on the timber supply and the harbor facilities, but as the timber is removed the land will be used for agricultural purposes and other industries will take the place of the lumber industry. Ships from all sections of the world load lumber directly from the large saw mills located here.

Vancouver (9,300), one of the oldest towns in the state, is located on the Columbia River where the main lines of the north and south railroads cross the river by bridge into Oregon. It is the center of a fine fruit growing and agricultural district. One of the oldest army posts on the coast is located here.

Centralia (7,311) and *Chehalis* (5,000) are located on the main railroad lines between Tacoma and Portland in a broad open country well adapted for agricultural development. With an annual rainfall of 46 inches, and a range of temperature between 40° and 61°, pasturage is good the year round, and much of the logged-off lands may profitably be used for dairying.

Olympia (7,000), the capital of the state, is located at the head of Budd Inlet, a long southern arm of Puget Sound. On the tide flats around the bay large areas are used for oyster beds. It is in the center of an important agricultural country formerly better known as a lumbering district. Tum-water falls on the Deschutes River, about which one of the oldest settlements north of the Columbia River was started, furnishes electric power for the city and the surrounding district. It has a very good harbor, but is too far from the Pacific and off the main transportation lines to be considered with the northern ports on the Sound.

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THE WEATHER FACTOR IN THE GREAT WAR: IV

October, 1915,—February, 1916*

By Robert De C. Ward
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WESTERN WAR ZONE

ON the western front the situation has remained practically *in statu quo*. The "see-saw" of military operations in relation to the changeable autumnal and winter weather of western Europe is the most striking fact. Clear weather favored artillery action and aeroplane activity; rain and fog made gun-fire difficult or impossible; mud checked the movements of artillery and of troops. Violent storms and snow, especially in the Vosges, frequently resulted in complete suspension of all military operations. During the French and British "drive" in Champagne and Artois in September and October, advantage was taken by the French of a heavy fog for making one of their attacks. The whole battle-line was in a "grayish mist." The generals and staff officers could not see the troops. A chilling autumn rain and "hailstorm" (doubtless "frozen rain"), followed by falling temperature, brought discomfort to the fighting and added suffering to the wounded. The ground was soft, owing to the rains, and the men were able to "dig themselves in" without difficulty. The interruption of the dull and thick weather by "brilliant sunshine and a cloudless blue sky," good for artillery observations, is noted in the despatches.

Snow "completely stopped" operations along the Anglo-French front at the end of November. The opposing forces, a mile apart, could not see each other's positions. With the coming on of winter (December) the reports of stormy weather became more numerous. A characteristic despatch (Dec. 4) read: "Stormy, rainy, and generally unfavorable weather interfered with active operations." Early in December, floods in the Yser region forced the Germans to abandon some of their advanced trenches. In mid-December continuous rains, floods, and deep mud made fighting on a large scale impossible. Roads were in many places under water. *Le Temps*, on Dec. 26, reported "the wind is blowing from the east, which will permit the enemy to use asphyxiating gases. It is, then, the most elementary prudence for us to be ready with masks, and to man the batteries." This is a significant statement: a forecast of a probable hostile attack because the wind was favorable for the

*Previous articles in this series have been published as follows: *Popular Science Monthly*, Vol. 85, Dec., 1914, 604-613; this *Journal*, Vol. 13, Feb. Mar., 1915, 169-171, 209-216; Vol. 14, Nov., 1915, 71-76. The date of closing the present paper was Mar. 1, 1916.

use of gas. Several cases were reported from this western war zone of the influence of wind. In September, a fire set by hostile projectiles within the French lines was driven back by the wind into the German lines, and caused "perceptible damage." During the Allies' big October drive the wind was noted as favorable for their use of gas, i. e., it must have been a westerly wind, of no great velocity. On Feb. 12, in Champagne, a change of wind rendered ineffective a large quantity of asphyxiating gas which had been relied upon by the Germans for enabling them to make a successful attack. In January (13th), also, the wind shifted while the Germans were using gas, and drove the fumes back into their own trenches. The very few reports of such occurrences during the war show how accurately the Germans have been able to forecast the wind before they have attempted their gas attacks. Early in February French artillery fire wrecked some German gas reservoirs in Champagne and the wind, being from the west, carried the gases over the enemy lines.

In mid-February widespread severe gales caused shipwrecks, interruption of Channel steamship service, and of telegraphic communication. The weather conditions along the war front were reported as the "worst since the war began," particularly in Belgium. The "terrible gale" made artillery fire very difficult.

It was to be expected that no general advance, on either side, would be made until the winter storms became less frequent and less severe, and the approach of more settled spring weather dried up the muddy and slippery ground. As between the French and the Russian fronts, weather conditions would naturally be more favorable in the former case. It was, therefore, no surprise to receive the news of the great German drive in the Verdun region, during the last days of February. It was early in the season for a "spring drive," but the Germans were doubtless making an early start in order to anticipate the expected "spring drive" of the Allies, and were perhaps influenced by favorable weather conditions which looked like a premature spring. The heavy German artillery had previously, according to Berlin despatches, been brought up with great difficulty owing to the bad weather and the condition of the roads. A blinding snowstorm (described as a "blizzard") developed soon after the "drive" began (Feb. 24-25), but did not stop the progress of the battle as a whole. At some points along the front where the snowfall was heavier, as east of the Meuse, a noticeable slackening of military operations apparently occurred. The snow was almost less of a handicap than the thaw which followed, making the clayey soil spongy and slippery, checking the German advance, and causing a temporary lull in the fighting. A Paris despatch notes that the Germans "seemed to welcome the blizzard as giving possible protection from the seventy-fives." Gas was used, but the wind was variable, and covered those who used it, as well as the enemy.* French am-

*This record closed with Feb. 29, when a crisis around Verdun had not been reached.

bulance men who went out to rescue wounded Germans found many of them frozen stiff.

In regard to the comfort of the troops during the winter, it is clear that far better preparations in the way of warm clothing, blankets, and other supplies were made than was the case a year ago. In spite of all precautions, however, there was much suffering on account of the icy water and melting snow in which the men had to stand and live in the trenches, with many cases of frozen feet. A sledge ambulance section was provided for transporting the wounded French troops who had been fighting among the snowy heights of the Vosges. It is worth noting that Germany stopped the exportation of snowshoes on Nov. 30.

THE EASTERN WAR ZONE

Weather has played an important part in the general plan of campaign as well as in the day to day operations on the eastern front. Unusual activity on the part of the Germans at the end of September was probably due to their desire to reach the line where they had planned to establish themselves for the winter. The question, how far to penetrate into the domain of Russia's "hitherto unconquered generals, January and February," was doubtless one of the most critical which the German military staff had to settle. The autumnal rains, and the resulting floods and swampy ground, proved very embarrassing to the Germans. The general German campaign against Russia obviously failed of its purpose. The Teutonic troops did not reach the northern seaboard towns which they set out to capture. The Czar's armies were not forced to their knees, and the Germans did not succeed in reaching a strong line on which to entrench for the winter. The "weather, the Cossacks and the quagmires" proved to be a more formidable obstacle than had been anticipated. On Oct. 26 Petrograd reported snow as falling, and the winter as setting in early.

The German preparations for the winter campaign were remarkable. Among these preparations are noted steam-heated, concrete-lined bombproof shelters; winter clothing and sleeping bags; alcohol to be used for daily rubbing of the body; white calico and linen to serve as protective covers for uniforms, trenches and supply wagons; "boring squads," to bore into the frozen ground, insert explosives, and thus make trench-digging easier. In spite of all these preparations against the conqueror of Napoleon—the Russian "General Winter"—many of the German troops were unable to dig themselves in, and had to spend the winter virtually on the surface. Whenever snow fell the movement of artillery and transport wagons of all kinds was hampered. On the other hand, as winter's cold froze the ground and the marshes, Russian activity was renewed all along the front. Thawing weather suspended all military operations; freezing weather stimulated them. A rapid thaw at the end of January in the Pinsk marshes (Petrograd despatch) resulted in "engulfing of enormous quantities of German caissons, munitions and gun

and in the loss of many men who were unable to extricate themselves from the "marshy labyrinth." Mild weather threatened the German trenches, dug on marshy ground, and seriously handicapped the German advance. The Russians confidently looked forward to the spring thaws as certain to make the German trenches along the northern front untenable.

The whole "marsh campaign," if we may so term it, has been of extraordinary interest. As long as the marshes were not frozen—and they seem to have been "open" much of the winter—no extraordinary fortifications were needed. It was a clear case of "stationary warfare." Neither side could well advance. Plank bridges were laid by the Germans from hummock to hummock and from trench to trench; block-houses, built on piles, stood up above the water or ice; miles upon miles of barbed wire entanglements zigzagged across the ice or were half submerged in the water; dynamite was used to break up the ice, and make it harder for the Russians to advance; sledges dragged provisions and ammunition where there was ice, and rafts and boats were used where the water was open. The warfare was a straggling guerilla warfare, over the ice and through the swamps. The hospital cases were mostly frostbites and "colds." And all through those great swamps are lying bodies of dead Germans and dead Russians, who were shot and disappeared in the dark waters; or fell through the thin ice, or lost their way and were drowned.

Never in all her history has Russia's ice-ring been as serious a handicap to her as in this Great War. Last winter, while Archangel was frozen up, about one-third of the munitions, provisions and other supplies came in by way of Vladivostock, whose harbor must be kept open by means of ice-breakers, and about one-third came from Saloniki, through the Balkan states. This winter the latter route has been closed. No wonder, then, that desperate efforts were made to keep open the harbor of Archangel. Ice-breakers were brought from Canada. Ice-breakers were built in England. And those that were available were put to work to prevent, or at least to delay as long as possible, the winter ice blockade of that lonely northern port. Navigation usually closes by December. This year the reports regarding the conditions of navigation there have been contradictory. U. S. Consul Winship, at Petrograd, reported under date of Dec. 30, that there was a shortage of ice-breakers at Archangel, and that the harbor was so heavily ice-blocked that steamers had great difficulty in getting out. It was then expected that the season of navigation would shortly close, until late spring. Last year the closed season lasted from December to April. In order to handle the immense amount of freight which has been coming through Archangel since the war began, a new double-track railroad is reported to have been built, to replace the old single-track narrow-gauge line.

Much has appeared in our press despatches concerning Russia's new ice-free port, Ekaterina (Alexandrovsk), and the new railroad line to it. This port is on the Murman coast of the Kola Peninsula, which forms an eastern

continuation of the larger Scandinavian peninsula and nearly encloses the White Sea on the north. A naval station was established here in 1899. Ekaterina Harbor is a good deal farther north than Archangel—it is over 150 miles north of the Arctic Circle while Archangel is over 100 miles south of the Circle. But while the latter port is ice-bound, Ekaterina is exposed to the warming influence of a branch of the Gulf Stream drift which follows closely along the coast, and the harbor is never frozen. The White Sea is out of the reach of this warm water. Hence Archangel is frozen. Russia thus has what she has so long needed—and never more than now—an ice-free port, nearly 500 miles nearer the Atlantic than Archangel is. The new railroad has been completely surveyed, and thousands of men were employed on its construction last summer, many of them Austrian and German prisoners of war. Pending the completion of the line, communication with Archangel has been established across the ice of the White Sea by means of sledges and motor trucks to the part of the railroad which is already in operation. In 1899 Count Witte had plans drawn for a railroad from Petrograd to Ekaterina Harbor, but it was not until the present war showed the urgent need of such a port that construction was really begun. American engineers and skilled laborers were imported from the United States to work on this railroad. A despatch from London, Dec. 29, mentions the voyage, "under the most favorable conditions," of the Norwegian S. S. "Kong Helge" from Tromsø (Norway) to Ekaterina Harbor, with a cargo of English and American machinery.

The *Berliner Tageblatt*, in September, made the statement that "winter is at the door, winter and the freezing of the White Sea, and the increasing difficulty of transporting American munitions through Siberia. It is not going too far, therefore, to say that Russian assistance is out of the question for the Entente for a long time to come." In the light of what Russia has been able to do, this prediction is seen to have been singularly mistaken.

THE AUSTRO-ITALIAN WAR ZONE

The meteorological handicaps have been severe in the mountainous country where the fighting between Italian and Austrian troops has been going on in the clouds, and amidst the glaciers and the snows of the Alps. No other part of the Great War has been fought out for so many months under equal conditions of hardship. Snowshoes and skis were provided for the troops to enable them to march and climb over the deep snows. Extra-heavy winter clothing and foot warmers were provided. The provisions were assembled in specially constructed weather-proof huts. The shelters for the men were supplied with stoves. It has been a long monotonous struggle—without appreciable and permanent gains on either side—against snow, and fog, and storm, and cold; with intervening spells of more favorable weather when military operations were stimulated. To follow the details of this campaign would be

tedious. Advantage was often taken of fogs and of snowstorms for making surprise attacks. Thus, on the night of Feb. 23-24, on Mount Santa Marta, an Austrian detachment, clothed in white, and advancing toward the Italian position during a snowstorm, was seen and repulsed. Many of the soldiers, fighting against the severity of the Alpine winter, were invalided home with hands and feet frost-bitten. To supply their troops with warm clothing, offices were opened by the women in the principal Italian cities, where furs of all kinds were brought in to be made into winter garments. The troops fighting in the region towards Trieste have found themselves in much more favorable weather conditions. Here, on the Carso plateau, in late summer and early fall, the men suffered from the heat, even in their light grey cotton uniforms. During the late autumn and winter the general cold-season rainstorms of that region have often interfered with military operations. Air raids have been numerous in this zone, in spite of fog.

THE BALKAN CAMPAIGN

The "military expert" who, early in October, prophesied that "a winter campaign of no small importance may be fought out in this warmer southern region" was right in his forecast as to the importance of the winter fighting in the Balkans, but was obviously ignorant of the severity of the cold-season weather conditions of that rugged district. The winters of the central and eastern Balkan countries are not very unlike those of eastern Germany. The snows lie deep on the mountains and in the passes. The cold is severe, often below zero (Fahr.) On the western coast, and in the south, milder winter climates prevail. The winters are cool rather than cold, and much like those of southern France. The rainfall along the Adriatic coast is heavy throughout the year, especially in autumn.

The Serbian campaign was carried out under great stress of weather. Early in the Teutonic invasion (Oct. 18) the autumnal rains and cold weather greatly impeded the movements of the guns and troops of the invading armies, and delayed the arrival of enemy reinforcements. In one despatch it was reported that "mud is to the Serbians what snow is to the Russians. Before to-day, Serbian mud has helped to delay the enemy and been a valuable auxiliary." The Teutonic advance "necessitated great exertions" because of the heavy rains, snows, and deep mud, and was inevitably very slow. This was a help to the retreating Serbians, but the mud also operated to prevent the arrival of the much-needed French and British reinforcements. "Terrible snowstorms" in mid-November made all operations very difficult. The difficulties under which the Germans were laboring late in November gave hope to the Entente allies, yet, as one German despatch put it: "Neither impenetrable roads, impassable mountains thickly snow-clad, nor the absence of reinforcements and shelter, were able to check our advance" (Nov. 29). Snow was reported at Saloniki at the end of November, and was taken by the natives as a sign of a severe winter. "Bitter weather," "heavy and continuous snowstorms, reaching the proportions of a blizzard," were reported. "Unquestionably, the weather is a material factor in the fighting," an Athens despatch

(Nov. 30) said, "and has had the effect of delaying the pursuit of the Serbian army in its trek into Albania." The sufferings of the Serbian refugees, including large numbers of aged persons, of women, and of children, were terrible. Struggling over rough roads, through cold and deep snow and rain, without sufficient food or clothing; dying, doubtless by thousands, of cold and hunger,—the story is one of the most tragic incidents of this terrible war. Fires could seldom be made, owing to the lack of wood. Vehicles and guns had to be abandoned, and many of the refugees were barefooted in the snow. A slight retirement of the French troops early in December was made necessary in order that winter quarters "less exposed to the inclemencies of the weather" might be reached. This retirement was facilitated by the delays experienced by the Bulgarian troops, owing to the snow and the state of the roads. At Saloniki the Allied troops suffered from the "damp and penetrating cold." Firewood was scarce. The most frequent cause of disability among the French soldiers who fought in the Serbian campaign, was frozen feet, necessitating many amputations. A concentration of German and Bulgarian troops at Monastir (Jan. 24), where shelter against the winter weather could be found, led the French to make an air raid to that city. The weather during the raid was fine, but the wind boisterous, from the north.

THE DARDANELLES CAMPAIGN

The Dardanelles campaign ended—at least for the time being—with the evacuation of the Gallipoli Peninsula by the English troops. Towards the end of the summer, in the dry season of that sub-tropical region, suffering from thirst was to be expected, yet the British military authorities seem to have made little provision for a water supply. The weather was hot, and the men suffered for want of water. Delays in the disembarkation and in the advance of the troops were occasioned by the necessity of first disembarking the mules for carrying water. A large reservoir, holding 30,000 gallons, with distributing pipes, was later built in the Anzac region. Old oil tins were also provided, and fitted with handles, to serve for carrying water to the men. Early in August Gen. Sir Ian Hamilton reported that "water troubles" prevented his carrying out his plans. All ranks (Aug. 10) were reduced to one pint a day. When the mules carrying the water-bags arrived at the front, "the men would rush up to them in swarms just to lick the moisture that exuded through the canvas."

Early in October one of our "military experts" observed that there were "still three months of good weather ahead for any new move" in the Dardanelles. His familiarity with the climatic conditions of the region was not to be depended on. On Dec. 7 Gen. Sir Ian Hamilton reported: "I regret to say that the measures actually taken for distribution (of water) proved to be inadequate, and suffering and disorganization ensued." The distribution of water from the landing-places did not work smoothly. The soldiers cut the hose in order to fill their water bottles, and some of the lighters grounded so

far from the beach that the men had to swim out to them for water. The Suvla Bay landing failed in its object, largely, without doubt, through the failure of the water supply. The sufferings of the troops on this account make painful reading. A Sydney (New South Wales) despatch, dated Dec. 15, noted the interesting fact that the Australians on the Gallipoli Peninsula, most of whom had never seen a snowstorm, had their first experience of the sort on Nov. 27. A "fierce and bitterly cold" northeast wind blew that night, with drizzling rain turning into snow. The next morning the men woke up to find the country covered with snow, and the snow still falling. This snowstorm, described as a "blizzard" and as being "a month before the ordinary date of such conditions in Gallipoli," caught the troops unprepared, with insufficient shelter and clothing. There was much suffering from the cold, and in the wet snow. The night of Nov. 28 brought a sharp, cold wind, with more snow, and the ground froze. This weather lasted for some time, during which the Quartermaster's Department was able to supply waterproof capes and rubber boots to some of the men. The Turks, also, seem to have been caught unprepared, and had to evacuate some of their trenches. Early in December the usual subtropical winter storms made it difficult to bring up provisions, and the continued lack of drinking water began to tell upon the condition of the men (Berlin report).

The final evacuation of the Peninsula was aided by a fog, which "fortunately hung low over the surface of the sea," but a gale during part of the time (reported as 35 miles an hour) made it difficult to use piers and lighters. Nevertheless, in spite of all obstacles, the British troops were all safely embarked, and the ill-planned and unsuccessful Gallipoli expedition came to an end.

THE CAUCASIAN CAMPAIGN

In their Caucasian campaign the Russians met very severe winter weather, yet neither intense cold (-20° to -25° F.), nor deep and blinding snowstorms, nor bad roads in a rugged mountainous country, at high altitudes, seem seriously to have delayed their progress. As far back as early December, snow, described as "ten feet deep," and "cyclones," which doubtless means gales accompanying the snowfall, hampered operations. In mid-January the Russians successfully fought the Turkish troops during severe snowstorms, "above the clouds," where trenches had to be dug in deep snow. The pursuit continued in spite of snowstorms and the absence of roads. The Russians advanced through deep snow ("up to their chests in snow"), across "almost inaccessible passes," in "intensely cold weather." The final operations around Erzerum, in February, were carried on under the most severe weather conditions, the snow being deep and the thermometer being reported as -30° F. The Russians have always been known as good cold weather fighters. They have maintained their reputation during the present war.

THE MESOPOTAMIAN CAMPAIGN

When the British expedition invaded Mesopotamia from the Persian Gulf, a new climatic district was added to the war zone,—one in which the weather types differ markedly from those which characterize any other portion of the war area except that in Arabia and Egypt. Mesopotamia is a country of aridity; of intense summer heat; of deserts and steppes; of mild winters, and of cold-season rains. In some of these respects it has a good deal in common with the Mediterranean countries, but its rainfall is less,—and its summer heat greater. The winter months bring the rainy season, but the total mean annual rainfall is only about 8 inches, and some years give but half as much. More rain falls on the mountains than on the arid lowlands. The Tigris and Euphrates floods come generally in late winter or spring. The highest summer temperatures average between 115° and 122° ; in individual cases they even run a few degrees higher. During the excessive heat the natives take refuge, during the day time, in underground dwellings in which the temperatures may be 10° — 25° lower than outdoors.

It will be remembered that Gen. Townshend's column, proceeding up the Tigris, captured the historic city of Ctesiphon, but partly because of lack of water was obliged to retire to the river when within a short distance (about 20 miles) of Bagdad. The reports mention marches "over burning sands"; intense suffering from thirst; temperatures of 128° to 130° ,—the latter readings doubtless too high for the time of year. It was necessary to keep the army near the river, where there was a plentiful supply of water. An officer in the Royal Field Artillery wrote of temperatures of 110° ; and of the exhaustion of the infantry in the very hot sun. "We cannot carry nearly enough water," he notes, "and one's tongue soon swells when the sun is up." The heat was "about the limit of human endurance." The men fell ill as a result of the excessive heat and of the bad water. The temperature in the hospital tents was reported as 130° , and this may easily have been the case. Under such conditions "the suffering of the wounded and sick was distressing to contemplate." On an afternoon march this same officer's goggles were so hot that they blistered his face, even under the shade of his helmet.

The relief expedition under Gen. Aylmer, going to the relief of the beleagured troops in Kut-el-Amara (January) met with serious difficulties on account of the rains. A London despatch (Jan. 22) mentions a "hurricane," which had made navigation and other operations most difficult. The Tigris rose rapidly. "Atrocious weather"; "incessant rains"; floods and deep mud continued. On Jan. 24, it was reported that the Tigris had risen 7 feet in 48 hours at Kut, "preventing all troop movements by land." It was a hard struggle against both Turk and weather, without definite result. "At this season," one despatch noted, "the Tigris is very full, with a strong current," thus giving an advantage to the British army, which was provided with pontoons.

THE CAMPAIGN AGAINST THE SUEZ CANAL

Much has been said about the possible, or probable, invasion of Egypt by the Teutonic Allies, and many contradictory, not to say erroneous statements have found their way into print. Exactly what has actually been accomplished by the Germans in preparation for this anticipated invasion cannot be determined at the present writing. It has been reported that the Turks, with the assistance of German engineers, were "pushing a railroad toward Suez, over 150 miles of desert," and were paralleling it with a pipeline for water. These water-mains were to be laid from Bir-es-Seba, where there are wells, and the water was to be driven by powerful pumps. Openings were to be provided at convenient intervals to supply the troops during the march. During the Turkish advance, some months ago, across this same desert, water was carried on the backs of camels and donkeys.

With the known climatic handicaps of the desert clearly in mind, there is nothing inherently impossible in the construction of such a railroad and in providing water, by means of tank cars or pipe line, and food. There is a report that German engineers were prospecting for water all through this region as far back as 1912. In the case of this proposed invasion, the greatest difficulties would pretty surely be encountered in the transportation, feeding and munitioning of the troops over such very inferior railways as those of Asia Minor. As to the water-supply available for a large army during its progress across the desert it is, of course, impossible to make definite statements. At the eastern end of the Mediterranean the rainfall along the coast averages somewhat over 20 inches a year, but the amount decreases to the south and west, so that even on the coast in the country which would have to be crossed by an invading army less than 10 inches fall annually. This is a winter rainfall. Hence winter would be the best season for such a campaign, both on account of the better water supply and of the lower temperatures. Yet the seasonal and annual rainfall is subject to great fluctuations, and cannot be predicted in advance. The supply is variable, and precarious, especially when the needs of the transport animals, as well as of the men, are taken into account. The climatic obstacles are not insuperable, but they are serious. To transport a large body of troops for 1500 to 2000 miles, probably exposed near the coast to the fire of British war vessels, to a fighting ground in the midst of a desert, facing the British troops with Egypt close at their backs, presents a problem which even the highly efficient German military staff might well hesitate to solve. We learn that the Germans have considered the use of air-cooled motors for moving artillery and supplies in the desert, in order to reduce the water requirements of the many transport animals which would otherwise be needed. In spite of its many disadvantages, a desert does possess one great advantage from the point of view of health. Its air is dry, and aseptic. Under any ordinary conditions of proper sanitation widespread epidemic diseases would not be likely to occur.

THE WAR IN AFRICA

From the widely-extended war zone in Africa but little detailed information has reached us, although great changes in political boundaries have taken place there. Late in November it was reported that with the beginning of the dry season there had come a renewal of activity on the part of the forces operating against the Germans in Kamerun. During the rainy season, great difficulties had been encountered in the movement of troops and supplies. About Christmas time a Cape Town despatch mentioned the sufferings of the Central African Imperial Contingent in its march against German East Africa, through Nyassaland. The heat was "terrific." The men wore "mosquito boots" reaching almost to their knees; gauntlets up to their elbows, and veils over their faces. The contrast between the abundance of streams in this region and the aridity of German Southwest Africa was a welcome one to the men who had previously campaigned in the latter district. The regime enforced by the medical corps was very strict. The men wore special caps under their helmets, to protect the top of the spine; they were warned against bathing in the afternoon, and had explicit orders to protect themselves against evening chills. It is a curious fact that the evening and night chill of the Tropics is one of the greatest dangers to health there. Gen. Wolseley is reported to have said of the Tropics, "not to get cold is to avoid almost certainly all the causes of disease."

THE WAR IN THE AIR

The war in the air has continued to show marked controls of weather, similar to those noted in the previous articles of this series. Some of the essential facts determining Zeppelin raids on England were clearly indicated by a member of a Zeppelin crew at the end of September. "Unfortunately," said this German, "the weather is the best ally of the English. Either there is no wind, or it is too windy. The beginning of the month of September was ideal. Cold nights set in, with a steady east wind. If we can get a steady east wind, and can float a considerable distance, thus conserving our petrol, London is within range." The Zeppelin raid at the end of September was favored by clouds, which concealed the air-ships. Aeroplanes of the Royal Flying Corps were unable, owing to a fog, to overhaul a Zeppelin which raided London about the middle of October. A German aeroplane took advantage of a bright moonlight night (Jan. 23) to drop bombs on the Kentish coast. Another raid, soon after, was interfered with by a "thick mist," so that bombs could not be dropped with accuracy.

A German air attack on Paris on the night of Jan. 29-30 showed that the French capitol was not immune from such invasions. The French explanation of the German success was that a fog prevented the French aeroplanes from damaging the Zeppelins by means of gun-fire. An Amsterdam despatch (Feb. 3) reported a Zeppelin flying low over a Dutch island, the aviator having lost his bearings in a fog. The Dutch guards bombarded the

air ship because of its violation of neutrality laws. In the last week of February, a Zeppelin which was trying to steal across the French lines near Bar-le-Duc, at high speed, was so delayed by a head wind that the French defense had time to bring up guns and the Zeppelin was destroyed.

In regard to the liberation of asphyxiating gas, whose safe and effective use is impossible unless the wind is in the right direction and of the proper velocity, the Germans have been sending up kites in order that they may determine the probable wind direction beforehand, and govern themselves accordingly.

PROTECTIVE MIMICRY AND WEATHER CONTROLS

A closing paragraph may be added on a few of the instances of protective coloring, employed during the war, in which the control of climate and weather appears directly or indirectly. The field-gray uniform was adopted, after long practical tests with all colors and shades of color, because it can least easily be distinguished against the summer gray-green fields and the grayish fog. During the winter, white uniforms, or dark uniforms covered with white calico or other light material, have been used in Russia, in the Alps, in the Vosges, and elsewhere. Even the guns and wagons have been covered with white. In the North Sea, with its cloudy skies, the German fleet is painted light gray; England and Russia use a somewhat darker gray. The English and German torpedo boats are black, in order to make them inconspicuous at night, when they are most often used. Russia uses dark green for her Baltic torpedo boats and submarines. But in the Black Sea fleet the Russian battle-ships and cruisers are light gray, the torpedo boats dark gray, and the submarines light gray-green. The lighter shades are better for protective purposes in the sunnier latitudes of the Black Sea. The French fleet, mainly intended for use in the Atlantic, is bluish gray; the torpedo boats are dark gray, and the submarines bottle-green, "just the color often seen in the sea on a clear, still day, when looking over the side of the ship." In the sunnier tropics war ships are painted white and torpedo boats light gray or slate gray. Air-craft are generally painted gray, to match cloudy skies, but a new device is to cover them with a glassy transparent fabric, which makes them less visible when the sky is clear.

The foregoing facts on protective mimicry are taken from an interesting paper by Dr. Hans Gunther, in a recent number of *Die Umschau* (Berlin).

Owing to the great output of petroleum in California and its use as a manufacturing, railroad, and steamer fuel, the production of coal in Washington has been considerably reduced during recent years. It is estimated that the consumption of California oil for fuel on the Pacific Coast is equivalent to about 21,000,000 tons of coal, or between 6 and 7 times the output of coal in Washington, or for that matter in all the Pacific Coast States combined, in 1914.

THE SOD HOUSE AS A FORM OF SHELTER; WHERE? WHAT? WHY?*

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AS a form of shelter in the Great Plains, playing a part in the history of the development of the United States and representing a real response to nature, the sod house merits our study. The little "soddy," so undervalued by the uninitiated and so little known, is but a passing curiosity to the car-window observer who hurries across the monotonous Great Plains east of the contrasting rugged Rockies. Even less attractive may be the abandoned "soddy" standing in pathetic dejection near the railroad. Practically nothing of an informational nature has been written about the sod house, hundreds of which still exist to shelter families and school children in the United States and Canada.

A RESPONSE TO ENVIRONMENT

The sod house, like the Eskimo igloo, is an immediate response to nature, telling a large geographical story. It differs from the igloo or the Bushman's straw hut in being a transitory form of shelter. It is overtaken by the modern frame house in much the same ratio that ranching is supplanted by agriculture. As an index to an important group of geographical conditions, it surpasses the log house and the dugout, which are found everywhere from the sub-arctic to the gulf, suggesting frontier conditions only, or an elementary standard of living, as with the negroes of the south. The facts will no doubt bear out the statement that the sod house, as a form of dwelling used by white men in the United States, is our most perfect type of primitive shelter which illustrates man's adaption to nature. This comparison does not include the Indian adobe house.

The geographical story suggested by the sod house may be resolved into the following problems:

1. Where are sod houses in use today?
2. Why?
3. How constructed?
4. What modifications appear in the original structure, and what do these changes indicate.
5. What change in related conditions has brought about a decrease in sod houses?

THE REGION OF THE SOD HOUSE

1. *Where?* It is in the Great Plains region of the United States chiefly that we find this interesting form of shelter, the sod house, constructed with such variations and modifications as the ingenious homesteader and the rancher can devise. By Great Plains we mean the western part of what people generally term the prairies, corresponding to those grass lands known in Asia as steppes, where treelessness is also due to "great extremes of climate,

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produced by remoteness from the ocean." As Herbertson tells us in *Man and His Work*, "The Russian word *steppes* denotes unwooded tracts in middle latitudes, of considerable extent, and covered with useful vegetation. The victory (here) belongs to the grasses, which grow with incredible rapidity."

As to the line of demarcation between prairies and plains, Brigham gives the widely accepted view: "The hundredth meridian runs through the Dakotas, central Nebraska and western Kansas. It is not the exact climatic boundary, but it is nearest to it, and it is easy to remember that eastward more than twenty inches of rain falls in a year, crops are raised without artificial watering, and we call the land prairies. West of the line there is no sudden change either of climate or topography, but on the average the rainfall is less than twenty inches, and irrigation is needed, except in unusual seasons, or for crops that require but little water. When we cross the hundredth meridian going west, we begin to be three thousand feet or more above the sea. We have crossed a plateau which has a gentle slant to the east. There is a central belt of the Great Plains which is smoother than the rest. It runs through Nebraska and Kansas and into Texas, and has been distinguished as the High Plains. In this central area there is rain enough to allow the forming of a sod, which is firm enough to check erosion by rain and by small streams."

Nebraska is an unusually good state in which to observe the relation of the sod house to topography and climate. Here, because the regions of the High Plains, Sand Hills and Prairies overlap, we must not confine the area of the sod house too closely to the western sections of the plains states. For example, in central Nebraska, in the Sand Hills region, sod house dwellings and school houses are not uncommon. We have the statement on good authority that in one of these counties alone there are at present from seventy-five to one hundred sod houses. This statement has greater significance when we bear in mind the sparsity of population.

The Sand Hills region of Nebraska is, paradoxically speaking, a wet-dry country. The sandy surface is dry, and struggling streams are few, but just beneath the surface there is an abundance of ground water. The location of the ranchman's home can here be permanent. Neither is he compelled to erect windmills as in the sections where the water table is low. Condra, in his *Geography of Nebraska*, says: "There is little surface water in the Sand Hills region. For miles in the hills proper no stream-channels are seen. The streams are abundantly supplied by spring water, but with little or no storm water. The open-textured, sandy soil absorbs most of the rainfall. Though the amount of moisture evaporated from the soil is large, there is not as much loss in that way as some have thought, a surface mulch of sand preventing excess evaporation. Much of the rainfall percolates downward through the sand and becomes ground water. The water table is nearest the surface at a distance from the river valleys, rising and falling with the wet and dry years. The amount of ground water in the region is great, more than would be expected

with the rainfall. Capillary water is present in the sand a few inches below the surface, extending from this point to the water table below. Lakes are common, and wet weather ponds are more common than permanent lakes."

THE "WHY" OF THE SOD HOUSE

2. *Why* should houses be made of sod? It is often the only available building material. The treeless plains are the grass lands for the extensive cattle ranches. The house is likely to be built a long distance from towns or railroads. To turn the firm, deep sod with a plow is quick work. The sod house involves practically no expense. In fact, the expense can be reduced to the cost of window-glass. It is easily constructed, and resists both heat and cold. It is stable and durable. The scant rainfall and rapid evaporation leaves the building intact. But few persons would on first thought associate stability and durability with a sod house.

3. *How* is a sod house constructed? Nature furnishes the material at first hand. She also deals kindly with man's handiwork. The house is put together most simply. Sometimes, as in the case of a school house, all the neighborhood families gather and build it in one day. No framework need be erected before the sod is laid. Any tough sod convenient to the building is used, such as blue-stem grass or hay meadow grass cut from a moist, compact land, a mile or less away. Autumn is the preferred time, when the roots are tougher and thicker. A dry time is best for laying the sod, as the building settles less.

The sod is cut in blocks two feet or more in length, a foot or more wide and two to four inches thick. It is laid block upon block like brick, with the grass side down. The length of the block determines the thickness of the wall. It can easily be seen that window and door casings will be wide when set in a wall that is several feet thick. The frames for these are of lumber, and are in place when the walls are being built up.

The roof of the early sod house was of sod, where now shingles are often used. It is able to withstand the showers. From the "draws" or "canyons" the homesteader secures the long pine and the saplings. We are reminded that the local details of surface vary in the western plains. The steep-walled ravines are often known as canyons. In the billowy Sand Hills region there are the "pockets" and basins and the barren "blowouts." In western North Dakota the deep valleys, which often furnish protection to animals from the storms of winter, are sometimes known as coulees. As Ellen Churchill Semple says, "The more flat and featureless a lowland is, the more important become even the slightest surface irregularities. In the dead level of extensive plains even slight elevations are seized upon for special uses, or acquire peculiar significance."

The first settlers had reason to prize highly such timber as they could procure along the streams and in little depressions where water had stood. The ridge-pole for the roof of the "soddy" is usually the long pine. Along the middle of each side of the roof a second long pole extends parallel to the

ridge-pole. Rough slabs are laid across the poles. These may be covered with tar paper or straw before the sod is laid for the roof, grass side down. The sod may be laid double, the second layer covering the openings in the first. The pitch, or slant, of the roof is slight. And invariably the stove pipe extends through the roof. The American homesteader seems not to have made a success of roof thatching.

THE INTERIOR

Questions and grave misgivings arise in the mind of the reader as to the interior of the sod house. It is here that the ranchman shows his superior civilization. In speaking of the American grass lands, Herbertson says: "The steppes of North America have been occupied, chiefly in the last half century, by settlers of North European descent, who have established large cattle-ranches. These have not reverted to pastoral habits in returning to pastoral life. This is partly because they came of a race which had acquired different characteristics during centuries of settled life, and partly because the construction of railways has opened markets and removed the isolation of steppe life, where nothing could be procured from outside sources, and each group had to supply its needs from the materials at its command."

There is frequently the strange anomaly of the sod house with its interior furnishings including a library, piano, rugs and pictures. The owner of the house may be a college-bred man or the father of children who are attending the university. The walls are trimmed smooth inside with a sharp spade, and plastered with a native clay, "giving a smooth, tan colored wall as easy to keep free from vermin as a frame building would be." Often walls are kalsomined, papered or whitewashed. A thin muslin is usually tacked over the ceiling, and is easily taken down to be washed when necessary. Pegs are driven into the walls for hat and coat racks and supports for shelves, without which a sod house would not be complete. The house varies in size, containing as many rooms as are desired, a covered passage often joining two buildings. The floors, usually excavated several feet, are of earth.

PERMANENCY

A well-build sod house may be occupied for ten, twenty or thirty years, with the sod roof renewed occasionally. Cool in summer and warm in winter, it furnishes secure shelter when the winds howl over the plains bearing the blinding blizzard or the grating sand. Flowers bloom in the deep window recesses the year around. Today many a family lives in the sod house as a matter of preference. In modified form, it is likely to remain in use for some time to come in the western counties of the Great Plains, where timber is scarce and transportation poor and towns are far apart. Dry farming and irrigation cannot encroach greatly upon the ranching country.

The spirit of independence that characterizes a people engaged in pastoral pursuits is strongly developed on the Great Plains. The view from each settler's home is boundless. This is the country over which Kit Carson and

Buffalo Bill rode in many a wild ride. Here is where Theodore Roosevelt lived a cowboy's life. Wholesome hospitality the traveler on the treeless plains may count upon. Near neighbors, ten or more miles apart, enjoy social gatherings. Railroads and automobiles are, however, rapidly removing the conditions that attend isolation, and the ranchman enjoys large opportunities.

HOMESTEAD LAWS

Growing out of the necessity for extensive ranching grounds in the semi-arid portion of Nebraska, that is in the Sand Hills and High Plains, congress passed a homestead law known as the Kinkaid Act, in 1904. The experiment of trying to convert this region into farms had failed generally. The Kinkaid Act allowed the homesteader to make an entry for 640 acres of land, instead of 160 acres, as formerly. Thus the homesteader makes up in quantity of land for what the soil lacks in quality and productiveness. He must depend almost entirely upon grazing and stock raising. "The use of wind-mills may enable him to grow a garden and perhaps a few acres of field products on his claim, but mainly his dependence must be upon utilizing the natural sparse growth of grass." Such lands are excluded from homesteading as may be reasonably practicable for irrigation by means of water conducted from natural streams, under the national irrigation law, or by private enterprise, particularly along the North Platte River. The old 160-acre homestead, as originally planned, had serious natural drawbacks on the Great Plains. These were the semi-arid conditions; the impossibility of reclaiming by irrigation on account of lack of water supply; the great elevation, ranging from 2000 feet at the eastern limit to 5000 feet or more at the western limit of the area, and being far above the level of streams.

In conclusion, we may say of the sod house:

- (1) It may be a home in every sense of the word; not a hovel or a sign of poverty.
- (2) It is the expression of a natural response to a physiographic region.
- (3) The study of it as such furnishes a concrete approach to the physical geography of the region.

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LITTLE HOLLAND

By Nell G. Hudson, Madison, Wis.

HOLLAND—"A land without mountain, rock or spring." A land of constant warfare where the weaker has been victorious—A never ending conflict between ocean and man. Neptune, not accustomed to defeat, is constantly seeking points of attack. Some battles he wins as in the thirteenth century when he overwhelmed seventy villages and took one hundred thousand lives for toll. The courage and perseverance of this little nation won, and the Old Man of the Sea retreated, growling, to his fortress.

The waves built sandbars, and later such material was built into sand dunes by the wind. These were taken advantage of by the Dutch as a fit foundation for entrenchments against the common enemy. Hence they were reinforced and added to until at the present time she has sixteen hundred miles of such embankments or dikes, including two of the largest dikes in the world. Since her very existence depends on the efficiency of these ramparts, she keeps an army of engineers constantly at work reconstructing, improving, building and watching for the least sign of weakness. This takes money and a great deal of it but the people furnish it without a murmur.

"By nature the country is a mudhole; by genius, energy, patience and faith of a noble people it has been changed into a garden."

Most English-speaking people mean the Netherlands when they say Holland. In reality Holland is only one of the eleven provinces that make up that kingdom. The whole country is about as large as South Carolina.

The country has two great natural advantages—good soil and an excellent position. Most of its soil has been transported; it is made up chiefly of sand, clay and organic mold, which the Rhine has brought from the Alps. This land surface is in general so low that it has to be drained. One third is below sea level. There is a regular network of drainage ditches. These, besides draining the land, serve in place of fences and act as roadways. It is said that there are 5000 miles of navigable waterways made up of rivers and canals, and taking up one fourth of the surface of the country.

Agriculture is the foremost industry of the little kingdom. They raise many things but are noted for bulbs, flowers and dairy products. Their scientific and even affectionate care of their cows is noted the world over.

GREAT COMMERCIAL INTERESTS OF HOLLAND

It is distinctly a commercial country. This is due to several reasons, among which are transportation, geographical position, valuable colonies and character of the people.

The prime purpose of ditches in Holland is for drainage, but thrifty people saw that they could be used for water transport while their embankments were fitted for roads and railways. Therefore no part of Holland is without ready access to markets and it is known as the "Land of Traders."

This little kingdom is the commercial key to northern Europe. It controls the mouth of the Rhine which is the commercial river of Germany. It is right in the path of trade between central Europe, America, and England.

The constant association of this people with the sea made them expert sailors. In the 17th century she was the first sea power. Hence in the discovery of new lands she took her part. In colonization she was most successful in the East Indies, although she has a foothold in northern South America yet. Today she trades heavily with these possessions and next to England has been most successful in her colonial schemes.

A LIBERTY-LOVING, PROSPEROUS PEOPLE

"Resolute, serious, vigilant, these people love intensely their cold, wet land. They have made the home beautiful and were the first to glorify it in art." Their dwellings are models of neatness. Tumbled down houses and latchless gates are unknown. It is a land where pauperism and crime scarcely exist. Thrift and economy prevail, with plenty for the rainy day.

Their very existence has been one of warfare with man on one hand and the ocean on the other. Her history is filled with change. At one time they were under the rule of Germany, then Spain, during which time they secured independence; they maintained a republic for two hundred fifty years and now a limited monarchy. Their sufferings made them sympathetic, broad-minded and independent.

People of advanced ideas sought refuge with them. The Pilgrims from England, the Huguenots from France, Germans and down-trodden people from anywhere, all came, sure of a welcome. These wanderers, in many instances, brought ways of doing things that were new and they gave the best they had to their benefactors. The Dutch took advantage of this opportunity and developed their manufacturing industries to a great extent. At present these stand next to agriculture.

Their largest city is Amsterdam, about the size of Baltimore. A canal connects it with the North Sea. The great seaport, however, is Rotterdam. It is situated near the mouth of the Rhine and is the terminus of many steamships from New York and elsewhere.

THE JOURNAL OF GEOGRAPHY INDEXED IN "THE READERS' GUIDE SUPPLEMENT."

As most users of libraries know, Poole's Index to Periodical Literature has been replaced by a similar publication, "The Readers' Guide" and "The Readers' Guide Supplement." The former is devoted mainly to the general magazines, while the Supplement is devoted to special magazines. The Journal of Geography belongs to the latter class and is indexed regularly in the Readers' Guide Supplement. This should be found in all of the larger public libraries and college libraries.

A NEGLECTED SOURCE OF GEOGRAPHICAL INFORMATION

Roland M. Harper

College Point, N. Y.

FOR years, especially since the invention of the half-tone process about three decades ago, it has been customary for railroads, hotels, land companies, boards of trade, cities, counties, etc., particularly in those parts of the world most frequented by tourists or where the population is increasing fastest, to publish for gratuitous distribution pamphlets and even books describing the resources and attractions of their respective regions. Many of these are beautifully printed, lavishly illustrated, and full of interesting geographical information; but comparatively few of them ever find their way to library shelves, for several reasons.

In the first place, many of them are of such odd sizes or irregular shapes that they are not well adapted to stand on shelves or be filed or bound with pamphlets of the more common sizes. Second, they are distributed so sporadically (few of them being copyrighted and most of them not even advertised) that no one person or institution can hope to have anything like a complete collection; and the fact that they cost nothing also tends to make them unappreciated. Thus they are rarely mentioned in scientific literature, for a conscientious writer hesitates to cite a publication, however trustworthy it may be, which few of his readers can ever see. Third, the difficulty of citation is increased by the fact that most of these pamphlets are anonymous and undated, and thus lack a certain appearance of authenticity that they might otherwise have. Fourth, being intended for the general public, they are necessarily superficial or untechnical in treatment, which may cause them to be looked upon with disfavor by some scientists. Fifth, as the main object of such literature is advertising, it is naturally biased, with a tendency to exaggerate the advantages and minimize or ignore the disadvantages of the regions described. Even the illustrations are not always what they purport to be, unfortunately, for when one community publishes a good farming scene, for instance, others may borrow it later to illustrate their own resources.

Most of the above objections will apply also to newspaper clippings, which are collected by some people, including the writer, and are often worth many times the trouble it takes to cut them out and label them. For the irregular sizes and shapes there seems to be no simple remedy at present, but the other objections can be met more or less successfully.

As far as accessibility is concerned, persons living in the larger cities have a constant source of supply in the ticket offices of the various transportation companies. Dwellers in smaller places are less fortunate, but can get many valuable pamphlets at small expense through advertisements in magazines and newspapers. Expositions and fairs are another happy hunting ground for collectors of free geographical literature. At the two California expositions

last year the writer gathered about thirty pounds of this material, and then had to decline some fine large state handbooks because already overburdened. California of course was better represented there than any other state, most of its counties having pamphlets to distribute. Of the foreign countries Canada and Australia were probably the most liberal in this respect. One of Canada's offerings was a quarto atlas, with separate colored maps of each province and much descriptive matter.

To the prevailing condition of anonymity there are some notable exceptions. Most state handbooks contain the names of one or more persons responsible for their authorship, sometimes including men of more than local reputation; and the same is true of some booklets dealing with smaller areas. For example, one of the California counties had its booklet written and printed by Elbert Hubbard, apparently only a few weeks before his death. And where the date is not given on the title page of a pamphlet it can often be approximated within a year or two by means of statistics given within. If possessors of such pamphlets take the precaution to mark them promptly with the date of accession they will know in after years that they were published between that date and the latest events mentioned in them.

If the treatment is untechnical it is not necessarily inaccurate, and is better adapted than a scientific treatise would be to students of the ages at which geography is commonly studied. As far as accuracy is concerned, the present standard for free geographical literature, with the possible exception of that issued by land companies, is higher than one might suppose without investigation. Many of the statements in these advertising pamphlets relate to facts which there would hardly be any motive for misrepresenting, or which can easily be verified in these days of rapid dissemination of knowledge. Even some state supplements to school geographies published during the present century are more extravagant, and even inaccurate, in describing the advantages of their respective regions, and say less of the disadvantages, than some of the literature here discussed. As regards the pamphlets collected in the West last year, the writer found no serious misstatements in any dealing with regions traversed on the trip. Not only that, but good use was made of several of them, especially during the weeks spent "on the road" without access to libraries, in revising state descriptions for an encyclopaedia then in course of publication.

It may be appropriate to mention briefly some of the choicest bits of free geographical literature acquired in preparation for, or in the course of, a trip to California and return. The Southern Pacific and Western Pacific railroads both issued for the benefit of travelers from the East descriptive folders, telling briefly what was to be seen around and between almost every station on their main lines, as well as such data as distance, altitude, and population. For the traveler who wished to spend all his time between stations in studying the landscape these answered about as well as the much more bulky and expensive transcontinental guide-books published by the U. S. Geological Survey (which came out too late in the summer to be of the greatest service anyway,

and then did not cover either of the two routes named, which in some ways are the most interesting of all). The Southern Pacific also gave out a large folded map of San Francisco, on the back of which was found almost all the information that a stranger could ask for; and there were similar maps of California and Nevada, with good general descriptions of those states. All of these are probably still to be had for the asking, and they should be a valuable aid to the study of geography in our schools.

GEOGRAPHY AT THE UNIVERSITY OF MICHIGAN

WITH the opening of the academic year 1915-16, geography work has been formally added to the work in geology at the University of Michigan, the name of the department being changed to that of Geology and Geography. Geography has also been made one of the subjects open to election by freshmen in the Department of Literature, Science and the Arts, and continues through the year four times weekly, the work of the first semester being devoted to physiography, and that of the second semester to anthropogeography. The work in physiography is conducted as heretofore by Assistant Professor Irving D. Scott, and the geography work by Carl Ortwin Sauer (Ph.D., University of Chicago). About 150 students have been enrolled in the freshman course, and an elective course in commercial geography given during the present semester has been elected by 115 students, showing plainly the need for such training at the university.

During the summer session of the university there will be included geography work in charge of Dr. Sauer, and in the next academic year in addition to the course in commercial geography, courses in the Geography of North America, and Geographic Influences in American History will be offered.

During the present year the following illustrated lectures by non-resident lecturers were delivered to popular audiences in the new auditorium of the Natural Science Building.

PROGRAM OF LECTURES

November 11—Miss Dora Keen, *Philadelphia*,

“The First Ascent of Mount Blackburn”

December 2-3—Dr. Ellsworth Huntingdon, *Milton, Mass.*,

“Weather, Work and Human Activity”

“The Ideal Climate and the Distribution of Civilization”

“The Past Distribution and the Cause of Climatic Changes”

February 24-25—Professor R. H. Whitbeck, *University of Wisconsin*,

“Some Geographical Influences upon the Trend of Civilization”

“The Reclamation of Desert Lands”

March 10—Professor Walter S. Tower, *University of Chicago*,

“Northern Chile and the Nitrate Industry”

A Journey through Argentina”

March 31—Miss Ellen Churchill Semple, *Louisville, Ky.*

"The Barrier Boundaries of the Mediterranean in the Present War"
"Geographic Influences in Japan"

April 21—Professor J. Russell Smith, *University of Pennsylvania,*

"Tree Crops and Conservation"
"The Desert and the Desert's Edge"

May 4-5—Dr. Edward L. Stevenson, *Secretary, The Hispanic Society, New York City,*

"The Expansion of Geographic Knowledge in the Middle Ages and its Record as given by the Map-makers,"
"Early Discovery and Exploration in the New World as Represented by Contemporaneous Map-makers." W. H. H.

GEOGRAPHY EQUIPMENT AT DENISON UNIVERSITY

TWENTY-FIVE miles northeast of Columbus, Ohio, is the village of Granville. In this village is one of Ohio's 42 colleges and universities; it is Denison University, with 500 students. Conspicuous among the college buildings is a particularly attractive new building, *Science Hall*. One floor of this is devoted to geology and geography, mainly the latter, and is presided over by Professor Frank Carney.

Considering how recently geography has risen to the dignity of a university study in America, one does not expect to find in a little college like Denison a well developed and excellently equipped department of geography. Yet this institution has such a department, furnished and equipped in a way that would do credit to a much larger institution. When you enter the building and note its floors of ornamental tile, base-boards of white marble, bannisters of ornamental iron-work, and wood work of quarter-sawed white oak, you feel that somebody appreciated the educational value of bringing students into touch with things of good quality and good taste.

When Professor Carney came to Denison 12 years ago the institution had no equipment for teaching college geography. During these years he has brought together an excellent equipment. The lantern slide collection numbers 6000, largely made in the department. Both lecture room and laboratory have specially designed frames projecting from the wall, holding some 30 or 40 maps mounted on spring rollers. Cases are provided for storing ordinary roller maps in vertical position. Counters with dust proof drawers store U. S. Geological Survey sheets and folios. The departmental library is large and light; the books in glass-doored cases, and all well indexed. There is a dark room, map mounting and work rooms, office and store rooms, and a large collection of relief models. The equipment, not including furniture or cases, has cost about \$12,000.

SUMMER COURSES IN GEOGRAPHY

By F. E. Williams

University of Wisconsin, Madison

UNIVERSITY OF CALIFORNIA, BERKELEY

In Introduction to College Physiography, Mr. Vander Eike.

Physical Geography in the High School, Mr. Vander Eike.

Field Course in Physiography, A Field Study of the Mount Whitney Region, Dr. Buwalda.

Economic Geography, Mr. Barnhart.

UNIVERSITY OF CHICAGO

Economic and Commercial Geography, Associate Professor Goode.

Geography of North America, Miss Lanier.

Elementary Field Course, Four weeks in southwestern Wisconsin, commencing June 19, Assistant Professor Jones.

Field Course: The Environs of Chicago, Second Term, Assistant Professor Jones or Mr. Taylor.

Political Geography, Associate Professor Tower.

Influence of Geography on American History, Miss Lanier.

Economic Geography of the United States, Associate Professor Goode.

Geography of South America, Associate Professor Tower.

Principles of Geography, First Term, Professor Whitbeck.

Geography in High Schools, First Term, Professor Whitbeck.

Field Geography, Region between Montreal and Halifax, Sept. 2nd for four weeks, Associate Professor Tower.

The School of Education of Chicago University offers courses in:

Geography in the Primary Grades: Home and World Geography, Associate Professor Baber.

Geography in the Grammar Grades: North America, Associate Professor Baber.

Geography in High Schools, First Term, Professor Whitbeck.

CLEVELAND SCHOOL OF EDUCATION, CLEVELAND, OHIO

Methods in Elementary Geography and Local Field Studies, Mr. Gregory.

Industrial Geography and Studies of Cleveland's Industries, Mr. Gregory.

UNIVERSITY OF COLORADO, BOULDER

Principles of Earth Science, Professor McCourt.

Field Geology, Professor McCourt.

Geographic Influences, Professor McCourt.

Climatology, Professor McCourt.

Geographic and Geologic Excursion, Aug. 5th to Aug. 29th to interesting places in Colorado, Utah, and Wyoming, Professor McCourt.

COLUMBIA UNIVERSITY, NEW YORK, N. Y.

Physical Geography and its Economic Aspects, Professor Johnson and Mr. Lobeck.

Physiography of the Eastern United States, Professor Johnson.

Field Work in Physiography, Professor Johnson and Mr. Lobeck.

Commercial Geography, Professor McFarlane.

Geography of Industry and Trade, Professor McFarlane.

Geography of Europe with Special Reference to the European War, Professor Johnson.

Geographic Delineation and Map Interpretation, Mr. Lobeck.

Mathematical Geography, Professor Jacoby.

The School of Education of Columbia University offers courses in:

The Teaching of Geography in the Lower Grades, Miss Kirchwey.

The Teaching of Geography in the Upper Grades, Miss Kirchwey.

The Teaching of Regional Geography in the Junior High School, Miss Kirchwey.

Continental Geography for Elementary Schools, Miss Kirchwey.

CORNELL UNIVERSITY, ITHACA, N. Y.

Physical Geography, Assistant Professor von Engeln.

Commercial and Industrial Geography, Assistant Professor von Engeln.

Physical Geography, Laboratory course, Mr. Elston.

Geography and Geology, Field Course and Excursions, Assistant Professor von Engeln and Assistants.

DENISON UNIVERSITY, GRANVILLE, OHIO

Teachers' Course in Geography, Professor Carney.

Industrial Geography, Professor Carney.

Geography of South America, Professor Asensio.

Round Table Conferences, Professor Carney.

HARVARD UNIVERSITY, CAMBRIDGE, MASS.

Physiographic Field Studies, Professors Woodworth and Wolff.

Field Geology, course in San Juan Mountains of Southwestern Colorado, eight weeks, Professor Atwood and Dr. Haynes.

Physiographic Field Studies, Professor Atwood.

INDIANA UNIVERSITY, BLOOMINGTON

Conservation of Natural Resources, Professor Cumings.

Advanced Field Work, Associate Professor Beede.

The School of Education of Indiana University offers courses in:

Teaching of Geography, Assistant Professor Williams.

Economic Geography, Assistant Professor Williams.

Relation of Geography to American History, Assistant Professor Williams.

UNIVERSITY OF IOWA, IOWA CITY

Physical Geography, four weeks, Assistant Professor Thomas.

Physical Geography, six weeks, Professor Trowbridge and Mr. Shipton.

Field Geology, Baraboo district, Wisconsin, Professor Trowbridge and Dr. Stephenson.

UNIVERSITY OF KANSAS, LAWRENCE

Physiography, Professor Haworth.

UNIVERSITY OF MICHIGAN, ANN ARBOR

Teachers' Course in Physiography, Dr. Sauer.

Geographic Influences, Dr. Sauer.

Commercial Geography, Dr. Sauer.

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

Physiography, Assistant Professor Posey.

Geography of North America, Assistant Professor Posey.

Teachers' Course in Geography, Assistant Professor Posey.

Field Courses in Geography (4 tours), Assistant Professor Lehnerts.

UNIVERSITY OF MISSOURI, COLUMBIA

Teachers' Geography, Mr. Parkins and Mr. Thomas.

Fundamentals of Physical and Human Geography, Mr. Parkins.

Geographic Influences in American History, Mr. Parkins.

Geographical Excursion, Mississippi River and Great Lakes, Mr. Parkins.

Field Course in the Wind River Mountains of Wyoming, June 12th to Aug. 2nd, Mr. Branson, Mr. Griley.

UNIVERSITY OF NEBRASKA, LINCOLN

Physical Geography, Associate Professor Bengtson.

Industrial Geography, Associate Professor Bengtson.

Geography of Nebraska, Associate Professor Bengtson.

UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL

The Teaching of Geography, Mr. Noble.

General Geography, Mr. Smith.

High School Geography, Mr. Smith.

Elementary Geography, Mr. Smith.

UNIVERSITY OF NORTH DAKOTA, GRAND FORKS

Physiography, Mr. Simpson.

Field Geography and Physiography, Mr. Simpson.

The Summer Courses in Geology and Physiography are given at Devil's Lake.

OBERLIN COLLEGE, OBERLIN, O.

Field Geology, Southern Vermont, Professor Hubbard .

OHIO UNIVERSITY, ATHENS

Physical Geography, Professor Thompson.

Political Geography, Professor Thompson.

GEORGE PEABODY COLLEGE FOR TEACHERS, NASHVILLE, TENN.

Elements and Principles of Geography, Section I, Mr. Colby; Section II, Miss Dopp.

Commercial Geography, Mr. Colby.

Geography, Peoples, and Commerce of South America, Mr. Colby.

Influence of Geography on American History, Miss Dopp.

UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA

Commercial Geography of United States, Assistant Professor Roorbach.

Climate and its Economic Influences, Assistant Professor Roorbach.

Resources and Industries of South America, Assistant Professor Roorbach.

SUMMER SCHOOL OF THE SOUTH, KNOXVILLE, TENN.

Home and World Geography, Miss Henderson.

North America, Miss Henderson.

Physical and Commercial Geography, Miss Henderson.

UNIVERSITY OF VIRGINIA, CHARLOTTSVILLE.

Physical Geography, Miss Kelley.

Industrial Geography, Miss Kelley.

Aims and Methods in Geography, Miss Kelley.

UNIVERSITY OF WASHINGTON, SEATTLE

Physical and Regional Geography, Professor Landes.

Traveling Course, includes Glacier National and Yellowstone Parks, Assistant Professor Saunders.

UNIVERSITY OF WISCONSIN, MADISON

Physical Geography, Assistant Professor Steidtmann.

*Geography of South America, Assistant Professor Finch.

*Agricultural Geography, Assistant Professor Finch.

Commercial Geography, Associate Professor Martin.

*Geography of Wisconsin, Associate Professor Martin.

*Glaciers and Glaciation, Associate Professor Martin.

*Field Course in Physiography and Geology at Devils Lake, Wisconsin, Four Weeks in August, Associate Professor Martin.

*May be taken for credit toward an advanced degree.

The foregoing list is incomplete. An effort was made to secure information from all of the larger universities and many of the smaller ones. Many did not respond to our inquiries and others did not send details regarding courses. Many normal schools give summer courses in geography.

MORE STATES ORGANIZE BRANCHES OF THE NATIONAL COUNCIL OF GEOGRAPHY TEACHERS

OHIIO. At the annual meeting of the Ohio Teachers of Science and Mathematics held in Columbus April 22nd, an Ohio State Council of Geography Teachers was organized. Marked enthusiasm attended the launching of the organization. Prof. Frank Carney of Denison University was elected president, and Prof. Wm. H. Holt of the Bowling Green Normal School was elected secretary and treasurer. The meeting passed a resolution authorizing the officers elected to divide the state into districts and select a vice-president for each district. Later it was decided to adopt the five divisions of the state recognized by the State Teachers Association, namely, a northeast, a northwest, a southeast, a southwest, and a central district. Each of these districts holds a Teachers Association annually. The State Council will probably carry on the local work through the vice-presidents of these districts. There is evidence that Ohio will have one of the strong and enthusiastic Councils.

Kentucky also organized a State Council in April. Miss Elizabeth Beckenbridge of the Louisville Normal School writes as follows regarding the organization: "Our State Educational Association met at Louisville last week and our Geography Department had its meeting Thursday afternoon in one of the assembly rooms of the principal hotel. Though it poured down rain the whole afternoon, both the room and the hall around the doors were crowded. I do not believe it would be an exaggeration to say that 200 people stood throughout the entire program. The three papers were excellent, but the part that pleased me especially was the interest taken in the round-table discussion following the papers. The motion was passed that the Chairman, Mr. R. P. Green, be given the power to divide the state into districts and appoint a leader for each district, the leader to be made responsible for 'getting certain things done in his district.' All of our newspapers are exceedingly kind about publishing announcements of our meeting."

Professor R. P. Green of the Bowling Green Normal School writes concerning this meeting: "A great deal of interest was manifested in the work and I am sure that you will hear good reports from Kentucky. We are planning to take up the work by Congressional districts and then by counties. A committee will be appointed to study our problems in Kentucky and carry out any suggestions that the council may wish to make."

Professor Green was elected president of the State Council and Miss Kalert of the Louisville Normal School, secretary.

RECENT PUBLICATIONS

ELEMENTARY GEOGRAPHY. VII+360 pp. ADVANCED GEOGRAPHY, VII+439 pp. Hinds, Noble & Eldredge, New York, 1915. 75c and \$1.10 postpaid.

The first impression one receives on examining the first book is that it is unusually large for an Elementary Geography. It contains almost as many pages as the ordinary advanced geography. There are 357 figures, and 30 maps.

The difficult matter of map scale has been met by the adoption of three scales only. All the continents except Europe are drawn to the same scale. The United States, Canada, Mexico, and Europe have the same scale, and the different groups of states of the United States are all drawn to a third scale. This avoids the common difficulty of making Maine appear larger than Illinois, and Colorado about half the size of Ohio.

The abundance of material, the numerous illustrations, and the easy familiar style make the book attractive to children. Mechanically, the book is strongly bound in cloth to withstand the wear and tear that books for the grades are sure to receive.

HERBERT BASSETT.

"THE PHYSICAL GEOGRAPHY OF WISCONSIN" (to be reviewed later) is a new educational bulletin of the Wisconsin Geological and Natural History Survey by Lawrence Martin. The book contains 550 pages, illustrated by 206 text figures and 41 plates, including photographs and colored contour maps. A relief model of Wisconsin appears in the volume as a folded map. The volume contains 18 chapters and 8 appendices. Two chapters are devoted to the state as a whole and to its physiographic provinces, 6 chapters to the Western Upland, including Driftless Area, Mississippi River, etc., 4 chapters to the Eastern Ridges and Lowlands, and 2 chapters each to the Central Plain, Northern Highland, and Lake Superior Lowland. Teachers may obtain copies of this book without charge by writing the State Geologist, Madison, Wis., and enclosing 15 cents for postage.

STUDENT'S MANUAL OF PHYSICAL, ECONOMIC AND REGIONAL GEOGRAPHY.

By Charles R. Dryer and James A. Price. 171 pp. American Book Co., New York, 1916.

This new laboratory or exercise manual for high schools is of the loose-leaf type. It is designed to be used in schools where but a short time is devoted to the study of geography.

A large portion of the manual is based on illustrations and statistics in Dryer's High School Geography and has 21 of the 57 exercises devoted to studies of the production and the distribution of the world's crops and minerals. The other exercises are in the field of mathematical geography, map construction, regional studies, climate and weather, ocean currents, soils, and commerce. The question method, generally adopted in similar books, is

used for the most part. Some of the lessons require observation and cover a portion of the work usually included in earth science.

The most important advantage of the work is that it can be used without laboratory equipment other than Dryer's High School Geography. This feature should appeal to teachers in the smaller high schools, which generally lack equipment, and to those teachers who are required to divide their teaching time between geography and other subjects. The plan of reenforcing the study of the printed text by a series of practical exercises will commend itself very generally to teachers. The number of exercises (57) is large enough to allow teachers to select those which appeal to them and to omit others.

F. E. WILLIAMS.

GEOLOGY, PHYSICAL AND HISTORICAL. By H. F. Cleland. American Book Co., New York, 1916. 718 pp.

Cleland's *Geology* is an advanced textbook in whose "section on physical geology the human relation has been emphasized whenever possible, while in the historical section the history of life from the evolutionist's point of view has been taken up in broad outline." The book has twenty-two chapters, ten devoted to historical geology, and the remainder to physical geology. The last-named section, which naturally appears first in the book, discusses the usual topics of elementary geology—weathering, the work of wind, ground water, streams, glaciers, the ocean, followed by the structure of the earth, earthquakes, volcanoes and igneous intrusions, metamorphism, mountains and plateaus, and ore deposits. The text is simple, comprehensive, and up-to-date. The illustrations are uniformly good, especially the block diagrams. Teachers of physical geography will find this book useful as a reference work, for, although the point of view is different, the topics of the section on physical geology are much the same as those of physiography. As a successful teacher the author has presented the subject clearly and interestingly. The book is decidedly creditable to American geology.

LAWRENCE MARTIN.

The Illinois Geological Survey has just issued Bulletin No. 26, **GEOLOGY AND GEOGRAPHY OF THE GALENA AND ELIZABETH QUADRANGLES**, by A. C. Trowbridge, Eugene W. Shaw and B. H. Schoekel; cloth, 233 pp., 25 plates, 50 figures, 2 folded maps. The several chapters deal with General topography, Geologic principles, Geology of the Galena and Elizabeth quadrangles, Glacial geology, Effect of wind, Work of ground water, Work of streams, Economic geology, Settlement and development of Davis County. To be reviewed later.

The American Book Company has recently issued its new two-book series of *Elementary School Geographies* by Professors Brigham and McFarlane. The books reached us too late for review in this issue.

HOME GEOGRAPHY, A TEXT-BOOK FOR PUPILS, BASED ON THE ILLINOIS STATE COURSES OF STUDY, by Douglas C. Ridgley and Laura M. Eye-stone. Published by McKnight and McKnight, Normal, Ill.

The authors of this book say in their preface, "This book is prepared with the express purpose of furnishing definite, concrete materials and directions to pupils and teachers for the study of Home Geography as outlined in the Course of Study for the Common Schools of Illinois." Blank pages are inserted for drawings and pictures, outlines are given for observations of the weather, the sun, moon, etc., lists of trees, birds, and wild flowers. Many questions are asked to be answered by pupils from their own observations.

Anyone who is teaching lower grade geography will find many helpful suggestions in this book.

HERBERT BASSETT.

NOTES FROM "GEOGRAPHY AND WORLD POWER"*

COAL. "It has been calculated that the coal used in our factories alone, all other uses whatsoever being excluded, gives the equivalent of the energy of 175,000,000 hard working men, and in such a useful form as men could never supply. The power of Greece, whereby she achieved such great things in all directions of human progress, was largely based in the first instance on the work done by the servile class. On the average each Greek free-man, each Greek family, had five helots whom we think of not at all when we speak of the Greeks, and yet these were the men who supplied a great part of the Greek energy. In Britain, we may say, every family has more than twenty helots to supply energy, requiring no food and feeling nothing of the wear and tear and hopelessness of a servile life. With a population of 45 million men, women and children, Britain's factories are worked by 175 million man-power. Her railways and steamships use 90 million man-power more. In comparison with the energy supplied to machines in which things are made to move by purely mechanical means, the physical energy supplied by the fewer than 20 million men and women scarcely count. We have become a nation of engineers, pressing buttons and pulling levers, oiling and packing, so that the great social machine will work smoothly and as easily as possible."

The United States. "Here, then, is the United States taking its place in the circle of lands, a new *orbis terrarum*, and yet outside that which has hitherto mattered, compact and coherent, with enormous stores of energy, facing Atlantic and Pacific, having relations with east and west of Euro-Asia, preparing by a fortified Panama Canal to fling her one fleet into either ocean, and attempting to secure the approaches to that Canal by the formulation of a Monroe doctrine which forbids control of any lands of the New World by Powers of the Old, but is effective at present only in those small and comparatively unimportant states lying round the seas through which vessels using the Panama Canal would pass.

*By James Fairgrieve; reviewed in the *Journal of Geography*, April, 1916, p. 308.

"Here, unlike the disunited states of Europe, in which men speak many languages and remember that through the long past years they have been at enmity, we have a vast land where people speak one language, with no long history of discord behind them—THE UNITED STATES."

NOTES FROM HUNTINGTON'S "CIVILIZATION AND CLIMATE"

"MENTAL activity reaches a maximum when the outside temperature averages about 38 degrees, that is, when there are mild frosts at night. Another highly important climatic condition is the change of temperature from one day to the next. People do not work well when the temperature remains constant. Great changes are also unfavorable. The ideal conditions are moderate changes, especially a cooling of the air at frequent intervals."

"Today a certain peculiar type of climate prevails wherever civilization is high. In the past the same type seems to have prevailed wherever a great civilization arose. Therefore, such a climate seems to be a necessary condition of great progress. It is not the cause of civilization, for that lies infinitely deeper. Nor is it the only, or the most important condition."

"It is notoriously true that in India there is almost no such thing as a fourth generation of Indian-born British. The original stock is so weakened by tropical conditions that the children must either be sent back to Europe to recover their health, or else they are enfeebled and their descendants soon die out."

"There can be little doubt that malaria, and the many other diseases which are characteristic of tropical countries, play an important part in causing a low state of civilization."

"Most of us think that in the northern United States we work fast in winter. As a matter of fact, the statistics of ten thousand people show that we work slowly. The ordinary impression is apparently psychological. In order to keep warm out of doors in winter we walk fast and this leads us to think that we do everything rapidly."

"The actual figures show that, taking the year as a whole, on dull days, especially the second such day when a storm begins to clear, we accomplish more than on bright days."

"Taking the year as a whole, uniformity of temperature causes low energy, a slight rise is beneficial, but a further rise is of no particular value, the beginning of a fall of temperature is harmful, but when the fall becomes a little larger it is much more stimulating than rise, when it becomes extreme, however, its beneficial qualities begin to decline."

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A CORRECTION.

Through an error Prof. J. Russell Smith's new book, Commerce and Industry, published by Henry Holt & Co., was advertised in the March issue of the Journal of Geography at \$1.35. The price is \$1.40.

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VOLUME XIV

JUNE, 1916

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